SCIENTIFIC AMERICAN

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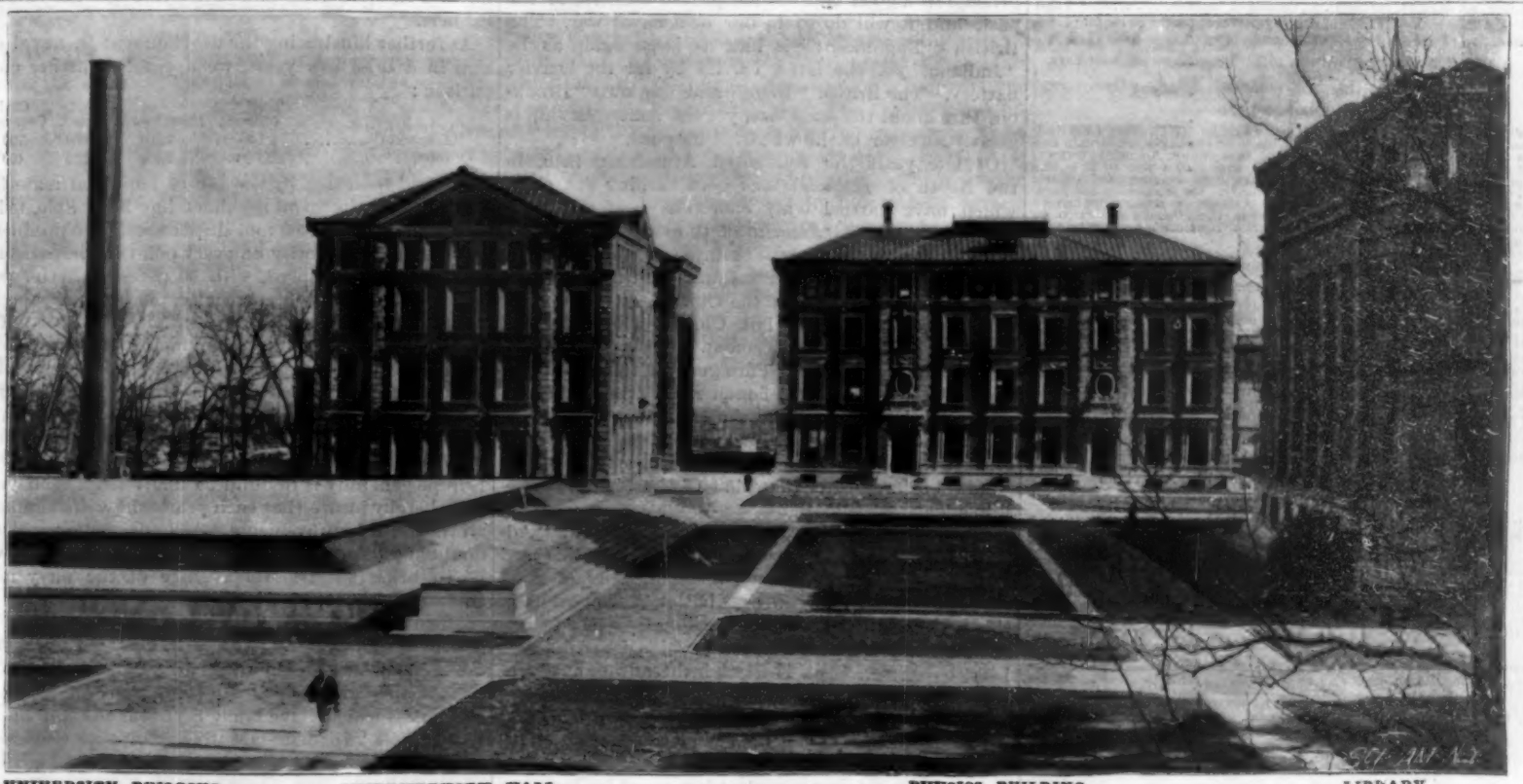

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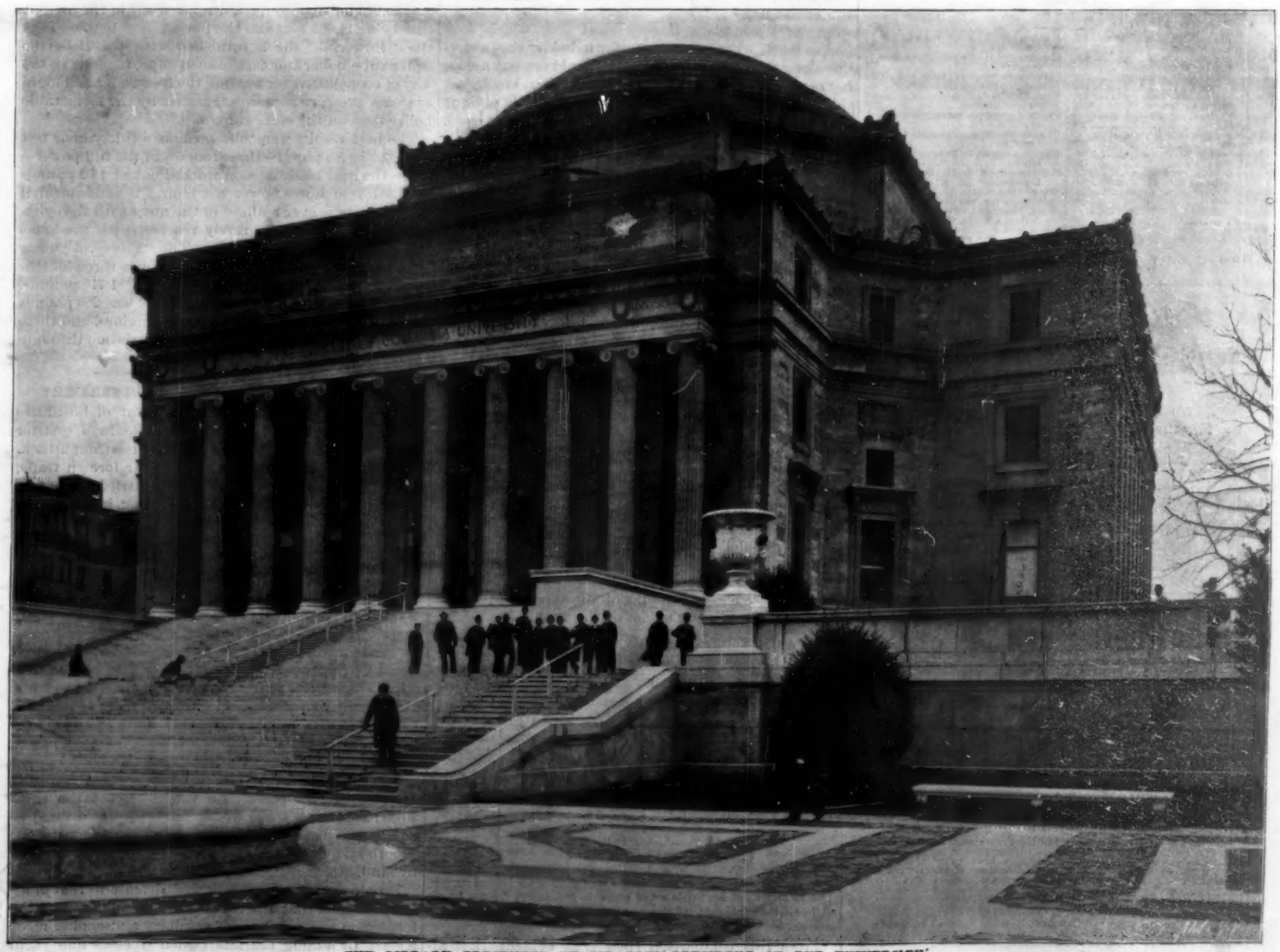

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THE NEW COLUMBIA UNIVERSITY.—[See page 200.]

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NEW YORK, SATURDAY, MARCH 26, 1898.

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(Illustrated articles are marked with an asterisk.)

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Scientific American Supplement

No. 1160.

For the Week Ending March 26, 1898.

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OUR RECENTLY PURCHASED WARSHIPS.

It may safely be said that Armstrong's is the only shipbuilding yard in Europe where we could have purchased two cruisers whose general features so closely approximate to the distinctive features of warship design as carried out in this country. From time immemorial American ships have been celebrated for their speed, and even more for the great power of their batteries. This was true in the days of the sailing frigate, when our ships were wont to crush their opponents with the weight of their superior gun-fire and their excellent markmanship, and the same powerful batteries are found on the ships of our new navy. The principle is a good one. It has proved effective in the past, and it will do so in our next naval war. The British "Magnificent" is half as large again as the "Indiana," yet the latter carries by far the heavier battery. The British "Blake" and our own "Brooklyn" are about the same size, yet the American ship is greatly superior in the weight of its guns.

Of late years the celebrated Armstrong firm, in the North of England, has been turning out ships which have carried truly enormous batteries compared with the displacement of the ships, and, at the same time, have shown themselves phenomenally speedy. The most noted instance of this is the renowned "Esmeralda," of the Chilean navy—not the old "Esmeralda," of the late Chilean war, but a new cruiser of 7,000 tons displacement. This vessel carries no less than eighteen rapid fire guns of the 8-inch and 6-inch sizes, besides eight 3-inch rapid firers and ten 6-pounders. From these guns she could pour into an enemy from either broadside during the first few minutes of the fight an amount of shell-fire whose total energy would be far greater than that of the biggest battleship afloat.

Our new acquisitions, the "Amazonas" and "Admiral Breu," are the very latest product of this yard and they exhibit the characteristic qualities of good speed and abnormally heavy battery, comparing in this respect with our own "Cincinnati." The principal dimensions, etc., of these twin ships are as follows: Length 330 feet, beam 43 feet 9 inches, draught 16 feet 10 inches, displacement 3,600 tons. They have twin screws and engines, the horse power being 7,500 and the speed 20 knots. Their normal coal supply is 700 tons, though they have stowage room for much more, and could therefore proceed at low speed far from our coal supply stations and reach hostile waters with a supply on hand. They are protected from stem to stern by a complete Harvey steel deck which is 3 inches thick where it curves down below the waterline along the sides. This 3 inches would present a sloping surface to the enemy, which would tend to deflect the projectiles. If they were not deflected the oblique 3 inches would be equal to a vertical wall of say 5 inches of Harvey steel. Before the shells could reach this deck, however, they would have to pass through 6 or 7 feet of coal which is stored in the wings of the ship abreast the engine and boiler rooms.

The battery, as we have said, is, for the size of the ship, very powerful. It is not only powerful in numbers, but owing to the fact that its guns are of the latest Armstrong pattern, they have vastly greater power for their size than guns that were built only four or five years ago. Armstrongs are the builders of the wirewound type of gun, which has shown results greatly superior to those obtained by the built-up type. Not only are these guns more powerful for their weight, but they have improved breech mechanism which enables them to be fired with greater rapidity. The following comparison of the Armstrong ship with one of the same size and type built for the British navy from government plans shows clearly the greater fighting power of the former. The figures are taken from the official tables of the British navy and the firm in question. The speed of fire is that actually obtained by crews on board ships in commission. The "Intrepid" is one of a class of thirty ships built under the late Naval Defense Act, and though not so up-to-date as the "Amazonas," may be considered as a good example of the average protected cruiser of the existing navies of the world.

COMPARISON OF TOTAL ENERGY OF FIRE DURING ONE MINUTE FROM EITHER BROADSIDE.

	Number and Size of Guns.	Muzzle Energy.	Shots per Minute from Each Gun.*	Total Energy.
"Amazonas," 1897	Four 6-inch.	4,840 foot tons	6	116,160
	Two 4·7-inch.	2,158 " "	12	51,792
	Five 2·24-inch.	280 " "	20	28,000
				195,952
"Intrepid," 1898	Two 6-inch.	3,350 " "	5	33,500
	Three 4·7-inch.	1,494 " "	16	44,820
	Four 2·24-inch.	137 " "	20	10,960
				89,340

*This rapidity of fire would not of course be maintained for any length of time in the excitement and slaughter of a modern sea fight. The figures, however, serve for the present comparison.

From this comparison then it is evident that although the two ships are of the same size, the "Amazonas" can deliver from her broadside more than double the energy of shell fire that the "Intrepid" can, although the latter ship was built only five years in advance of the former—such is the rapidity with which naval science and construction advances.

Foot-ton energy, which we have chosen as the basis of comparison, is the product of weight or mass by velocity; and as the weight of the shells for each caliber of gun is the same, the increase in energy is due to the very high velocities of the "Amazonas" guns as compared with those of the "Intrepid." Thus the 6-inch rapid fire Armstrong gun has a velocity of 2,642 feet per second, against 2,200 feet for the British naval gun; the Armstrong 4·7-inch gun has 2,630 feet per second, the naval gun 2,188 feet, and so on through the smaller calibers.

As further illustrating the development in naval design in a brief five years, we append a further comparison:

	Thickness of Deck.	Horse Power.	Speed.	Coal Capacity.
"Amazonas".....	3 inches.	7,500	20·00	700
"Intrepid".....	2 "	9,000	19·75	400

We find then that by the use of improved materials and methods the naval architect has been able, using the same capital (3,600 tons displacement), to produce a ship having superiority on every point of comparison—a ship with more speed, with 50 per cent better protection, 80 per cent larger coal capacity, and over 100 per cent more powerful armament.

We can imagine no more convincing argument for a systematic and continuous programme of naval shipbuilding than is presented by a study of these figures. The "Intrepid" was one of seventy-two warships which were authorized in a single appropriation and built with a rush. The present policy in England and Europe generally is to build so many ships each year, and thereby insure that each year's ships shall embody all the latest improvements. A similar policy will undoubtedly be adopted in this country, and its effect will be to bring the general average of the navy more thoroughly up to date.

THE EFFICIENCY OF THE WATER TUBE BOILER.

The efficiency of the water tube boiler needs no demonstration at this late day; but the coal consumption trials which have lately been carried out on the new cruiser "Diadem" are worthy of note because of the size of the boiler installation and the high economy realized. The "Diadem" is a smaller edition of the "Powerful," which was of 14,000 tons displacement and 26,000 horse power, the displacement in the present case being 11,000 tons and the horse power 16,000. Like the "Powerful" she is furnished with the Belleville water tube boiler and carries such improvements in the way of economizers for heating the feed water and higher steam pressure as were suggested by the memorable boiler tests on the older ship.

The best results were obtained on a thirty hour test at 12,500 horse power—three-fourths of the full power—when the coal consumption worked out at 1·59 pounds per indicated horse power per hour. It is doubtful if this low rate is ever realized in the navy with the cylindrical boiler, and it is rarely reached with the same type in the merchant marine. The "Powerful" using the same boiler burned 1·83 pounds on a three-fourths horse power trial and the "Terrible" 1·71 pounds. The steam pressure on the "Diadem" was 280 pounds at the boilers and 245 pounds at the engines, and these pressures were maintained with little variation throughout the trial.

IS OUR MARITIME COMMERCE VULNERABLE?

It is a fortunate fact that in the event of hostilities we should be practically invulnerable in a quarter where most nations would be open to disastrous attack. Great and rapidly increasing as is our foreign trade, only a very small percentage of it is carried in American ships. Although American shipping, inland, coastwise and deep sea or foreign, ranks in the aggregate next to that of Great Britain, we are secure from attack for the reason that the bulk of it is confined to the lakes and our great inland canal and river systems. As regards our foreign trade, for the year ending June 30, 1897, the proportion of foreign commerce carried by American ships was a fraction over 11 per cent, and for the month of December, the same year, it had decreased to about 7¼ per cent. Thus it will be seen that in the fiscal year mentioned, for one ton of our commerce that was exposed to attack there were about nine tons which were safeguarded by the laws of neutrality.

Nor would our coastwise commerce, which is carried entirely in American bottoms, be so seriously affected as might be supposed; for the fastest of the ships which are in this trade would probably be utilized as auxiliary cruisers, and the merchandise, thanks to our superb system of seaboard railways, could be shipped by land.

Turning from the question of defense to that of attack, we note that the Naval Board appointed for the inspection and purchase of auxiliary cruisers has made a start by adding the late Ogden Goelet's fine yacht the "Mayflower" to the fleet. This is a brand new vessel of 2,400 tons and about 17 knots speed. The

vessel is to be transformed into a torpedo boat destroyer at the Brooklyn Navy Yard under the supervision of Naval Constructor Bowles. She will be armed with rapid-fire guns of sufficient power to insure her sinking such torpedo boats as her 17-knots speed will enable her to overhaul. This catching of torpedo boats will not be so difficult a task as might be supposed, for these little craft are only capable of high speed under the most favorable conditions of wind and sea.

The purchase of several other swift merchantmen, yachts and ocean-going tugs is also under contemplation by the Board.

REPORT OF THE COMMISSIONER OF PATENTS FOR 1897.

In the SCIENTIFIC AMERICAN of January 29 we published an advance statement of the business of the United States Patent Office last year, to which but little is to be added from the official report of the Commissioner, which has just appeared. A full abstract of the report appears in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT. The report is made by Acting Commissioner A. P. Greeley, upon whom the duties of the office devolved for so great a portion of the year, on account of the illness and subsequent death of the former Commissioner, Gen. Butterworth, and shows the largest business ever before transacted in one year in the history of the Patent Office, there having been 47,904 applications for patents and 23,794 patents and reissues. The receipts of the year were $1,375,641.72, or $252,748.59 above the expenditures—and the latter amount, carried to the balance already standing in the Treasury of the United States on account of the patent fund, brings the total up to $4,971,438.06. It is perhaps futile, at this juncture, to more than call attention, as we have done so many times before, to the substantial wrong inflicted upon inventors by the diversion of so great a sum from the fees which they have paid to the government, when the needs of the Patent Office for a larger force of examiners and clerks, and for more commodious and convenient quarters in which to transact the business, are so well known. The appropriations made by Congress for the work of the office have been so meager that, although the fees received for patents are so largely in excess of the expenditures, it has not been possible to increase the force or facilities to meet the steadily enlarging field of work, and the number of applications awaiting action at the close of the year was 11,382, of which 7,858 had not been taken up for examination. Many of these applications had been waiting three or four months for examination, and some of them more than six months, to the serious injury of the applicants and the detriment of the public.

Of the patents granted last year, more were issued to citizens of Connecticut, in proportion to population, than to those of any other State—1 to every 786 inhabitants. Next in order were: Massachusetts, 1 to every 1,180; District of Columbia, 1 to every 1,316; New Jersey, 1 to every 1,377; Rhode Island, 1 to every 1,421; New York, 1 to every 1,585. The fewest patents in proportion to inhabitants were: South Carolina, 1 to every 38,371; North Carolina, 1 to every 17,397; Mississippi, 1 to every 16,120; Alabama, 1 to every 15,598; and Georgia, 1 to every 14,133. Of patents granted to citizens of foreign countries, 706 were for England, 551 for Germany, 286 for Canada, 222 for France, 58 for Austria-Hungary, 48 for Scotland, 45 for Belgium, 44 for Switzerland, 32 for Sweden, 30 for New Zealand, 30 for Victoria, 21 for Russia, 19 for New South Wales, 17 for Ireland, 13 for the Netherlands, 10 each to Denmark and Italy, 9 each to India, Mexico and South African Republic, and 5 each to Norway and South Australia.

The development of industries through patented inventions is treated of at some length in the report, and attention is called to the number of inventions of the highest industrial and commercial value for which the patents have expired. These include the cotton gin, the sewing machine, the self-binding harvester, barbed wire fencing, the roller mill for flour milling, the sulphite paper process, the dynamo and electric motor, important inventions in typewriters, the telephone, and many others, in the earlier forms in which they were brought before the public. It is to be remembered, however, in regard to most patents of high importance that the original inventions afford but the first steps in opening up new and more varied fields of industry, calling for additional improvements and the exercise of further inventive genius.

It is noted that the most remarkable industrial development, due principally to patented inventions, is in the line of electrical work, and within the term of patents now in force or but recently expired. This includes the manufacture of electrical apparatus and supplies, the furnishing of electricity for lighting and power purposes, electric railways and the telephone, an enormous industry, which has grown up entirely within the last twenty years. Although the electric railway is only about ten years old, the total mileage of these roads had increased, up to October last, to 13,765 miles, with an invested capital of about $1,000,000,000, and the manufacture of cars and motors to meet this great demand has become a regularly established industry affording employment to many thousands.

The bicycle industry is also referred to as showing a most wonderful development, the product of 1897 having been over 1,000,000 wheels, and the exports of cycles for the year being valued at $6,902,736. The numerous industries which contribute to this manufacture, and the great number of inventions by the means of which it has been brought to its present state of perfection, are matters of common knowledge.

Among other comparatively new industries, specially noted as peculiarly the product of our patent system, are the manufacture of typewriters and typewriter supplies, the cash register and cash carrier, photographic apparatus and materials, the development of the basic steel business, the manufacture of aluminum, etc., the Commissioner concluding that "to the stimulus afforded by the Patent Office is due the creation of these new industries and the very great development of recent years in the older industries. It is to the stimulus to invention given by our patent system that the great increase in our exports is largely due, and it is on American invention, as fostered and stimulated by the patent system, that we may confidently depend for ability to maintain the high rate of wages paid to American workmen, and yet compete successfully in the markets of the world with nations where the workman receives but a meager return for his labor."

THE NEW NAVAL WAR GAME.

In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT we publish a paper descriptive of a naval war game which is being played by naval officers on the other side of the water. It is intended to represent on a board the actual conditions which would obtain in a modern naval fight, and it is claimed by naval experts that it does this with such success that the game is at once a valuable training to the officers and a test of the comparative values of the various types of warships.

The full details of the game, which represents over ten years' work upon the part of the author, have not yet been published; but the published data shows that it is played upon a board ruled into squares, representing the scene of action, the ships being represented by small models which are moved at their respective speeds (ten, fifteen or twenty knots, as the case may be) at the will of the commanding officers. The game may be played as a duel between two ships or as a fleet action between a large number of ships. The models represent actual ships, and one player is assigned to each ship. The various elements in a warship, such as armor, guns, speed, etc., are assigned certain values by points, and as the game proceeds, the players, it would appear, are awarded so many points by the umpires, according to their tactics.

It is claimed that the victory usually falls to the stronger ship or fleet—a fact that would seem to prove the correctness of the theory upon which the game is based. At the same time, there are certainly exceptions to the rule, as in the case of a game recently played, in which the United States battleships "Indiana," "Oregon" and "Iowa" were pitted against double the number of Spanish ships, viz., the battleship "Pelayo," the three armored cruisers "Teresa," "Cristobal Colon" and "Viscaya," and the destroyers "Terror" and "Furor." Here, in spite of the numerical superiority of the Spanish, the American ships, with their heavy guns and thick armor, would be almost certain to win. As the game worked out, the balance was slightly in favor of the Spaniards, owing chiefly to the distraction afforded by the attempt of the destroyers to torpedo the "Indiana" and "Oregon," which diverted the fire of these ships from the Spanish armorclads. It is considered that, in nine chances out of ten, the game would result in the victory of the powerful few over the individually weaker many.

THE DEVELOPMENT OF EGYPT.

An important step in the development of the Nile Valley has recently been taken in the formal ratifying by the Khedive of the contract for the construction of two large reservoirs on the Nile. The work is planned on a large scale and includes the construction of two great dams across the river, one at the cataract at Assuan and the other at Assiut. At Assuan the waters will be impounded by a granite dam which will be built upon the granite reefs which form the cataract. Its crest will be about 76 feet above the river bed at its deepest point and the total length of the dam will be about 6,000 feet. The difference in the water level in the wet and dry seasons will be about 45 feet. It will be pierced with sluiceways to permit the flood waters to flow through without any considerable backing up in the reservoir.

In the fall of the year, when the waters have carried down their valuable burdens of silt for the enriching of the Nile Valley, the sluice gates will be shut down and the reservoir allowed to fill. The season of low water lasts from April till August, and during this period the sluice-gates will be opened sufficiently to keep the waters of the lower Nile at the proper level for irrigating the sugar, cotton and rice fields. It is calculated that the amount of water impounded will be sufficient to supply the lower valley until the next season's flood waters come down. If the scheme is successful, the Egyptian husbandman will be able to irrigate his fields throughout the whole year.

The Assiut dam is to be built for the purpose of raising the level of the river during the summer and increasing the supply in the canals of lower Egypt. It will be built on the lines of the celebrated barrage of the Nile, which is situated just to the north of Cairo. This important work is to be completed in five years, and its effect upon the districts affected will be to enormously increase the value of the land and the prosperity of the people.

STREET CAR SERVICE ACROSS THE BROOKLYN BRIDGE.

The new trolley car service across the Brooklyn Bridge has now been running long enough for the public to judge of its value. There can be no doubt as to the relief which it has afforded to the congested travel on the regular bridge cars, particularly in the rush hours. The crowding, indeed, seems to have been transferred to the trolley cars, which are particularly attractive to that part of the public to which rigid economy is an absolute necessity. Residents in Brooklyn can now make the journey from the outlying districts to the City Hall Park, New York, for one fare; and while the journey takes longer to accomplish than it does over the elevated roads and the regular bridge cars, the small difference in cost is sufficient to attract a large amount of suburban travel. The effect of the new service is plainly noticeable on the elevated roads, which, while they retain most of the long-distance travel, are losing a considerable amount of travel to and from points nearer the bridge.

It is estimated that the trolleys provide an additional capacity of 15,000 passengers per hour in each direction, and, as was expected, there has been a large reduction in the receipts of the regular bridge cars. Hitherto the revenues of the bridge have exceeded its expenses; but it is evident that some readjustment will be necessary, either in the shape of retrenchment in the operating expenses or assistance from the city funds. If the last expedient becomes necessary, the public will ask why the consideration paid by the trolley companies for the use of the bridge was not placed at a higher figure.

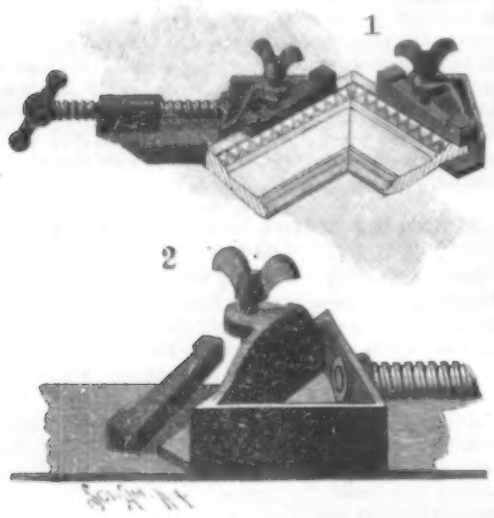
The cars are run on the inside of the roadways, and at the New York end they cross the footway beneath the terminal station in four parallel loops. A large force of men is stationed at the loops to prevent accidents and assist the people on and off the cars. The arrangement, thanks largely to the intelligence of the passengers, works satisfactorily; and altogether we think the new venture may be voted a success as helping to solve one of the most serious rapid transit problems in this city.

EATING BEFORE GOING TO BED.

A writer in Italia Termale, quoted by The National Druggist, December, is not much in favor of the theory that late suppers are injurious. "He declares, in fact," says the latter paper, "that many persons who remain thin and weakly, in spite of all precautions in regard to diet, etc., owe the fact largely to habitual abstemiousness at night. He says, very truly, that physiology teaches us that, in sleeping as in waking, there is a perpetual waste going on in the tissues of the body, and it seems but logical that nourishment should be continuous as well. The digestion of the food taken on at dinner time, or in the early evening, is finished, as a usual thing, before or by bedtime, yet the activity of the processes of assimilation, etc., continues for hours afterward; and when one retires with an empty stomach, the result of this activity is sleeplessness and an undue wasting of the system. 'All other creatures,' says the writer, 'outside of man are governed by a natural instinct which leads those having a stomach to eat before lying down for the night.' The infant, guided by the same instinct, 'takes the breast' frequently, in the night as well as day, and if its stomach is allowed to remain empty too long, it shows its discomfort by noisy crying. The digestive organs have no need for repose, provided, always, that the quantity of nourishment taken within the twenty-four hours does not go beyond the normal limit. The fact that the intervals between meals is short works no inconvenience, but, on the contrary, tends to the avoidance of feebleness, which is the natural result of an interval extended to too great a length. Feeble persons, lean and emaciated people, and, above all, those suffering from insomnia, owe it to themselves not to retire without taking some nourishment into the stomach—bread and butter, a glass of rich milk, a few biscuits ('crackers'), or even a bit of juicy cold meat, for instance. We quite agree with the writer in all that he says in regard to the folly of the idea of the harmfulness of a light lunch before retiring."

A NOVEL MITER CLAMP.

To hold the ends of mitered moulding or similar stock while being glued or otherwise secured together, the clamp shown in the illustration has been invented and patented by Alois Kohler, of No. 448 East 149th Street, New York City, Fig. 1 representing the device in use and Fig. 2 being an enlarged view of one of the clamping blocks. At one end of a suitable base bar a triangular clamping block is secured by a threaded

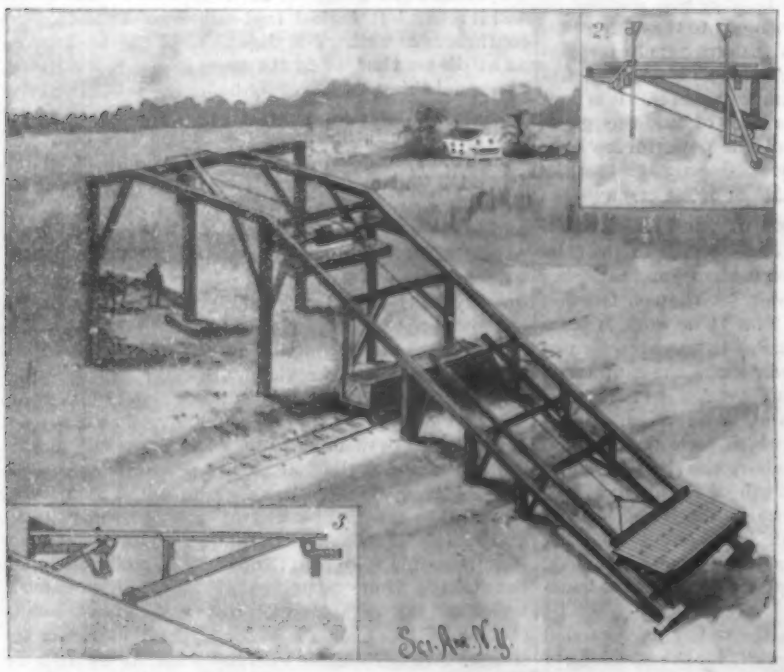


KOHLER'S MITER CLAMP.

bolt passing up through the base, whereby the angle of the face of the block may be changed if desired, and on the upper face of the block is a projection through which passes a set screw, by which the clamp may be set to hold mouldings of different thicknesses, a wedge being interposed between the lower end of the screw and the moulding. By slightly driving the wedge, the moulding may be clamped without turning the screw, or the latter method may be employed where the sliding of the wedge might mar the moulding. An opposite similar but sliding clamping block, shown in Fig. 2, has at one side a socket receiving one end of a threaded bar passing through a threaded lug on the base, whereby, on turning the handle of the bar, the second clamping block may be moved forward to clamp the moulding, as shown in Fig. 1. A wedge may be used with this block as with the other one, the use of the set screw giving a wide range of adjustment, while the wedge gives quicker action in securing or releasing the moulding.

AN APPARATUS FOR LOADING CANE, ETC.

The means shown in the accompanying illustration, for facilitating the transfer of cane and similar products from wagons and carts to cars, carriers or platforms, form the subject of an invention for which a patent has been recently issued to E. W. Wiley, Jr., of Le Compte, La. The larger figure represents the apparatus in use, Figs. 2 and 3 being sectional views indicating the manner of opening and closing of the carriage floor, Fig. 2 showing the floor open, as in delivering the load. The carriage at the foot of the inclined way is large enough to hold a wagon or cart load of cane, which is dumped on it, the carriage being drawn up the incline by a rope passed around a hoisting drum, and from this drum a rope connects with a counterbalance drum so arranged that the weight suspended from the latter drum will balance the weight of the carriage and one-half of the load. The carriage floor is composed of two interlapping trap doors, provided with an automatic trip and automatic shutting mechanism, the trip wheels running on a terminal intermediate track which is of such length as to allow the doors to open when the carriage has reached the proper position on the incline over the car to be loaded. After the load has been discharged, and as the carriage commences its descent, the trap doors are gradually closed, one of the trip wheels engaging with the intermediate track. The whole operation is automatic, it being impossible for the load to be prematurely discharged, and the construction being such that there is no danger to teams, there being no necessity for carrying ropes or slings on the wagon, as is necessary in so many forms of hoists. Four of these machines were in successful operation last season.



WILEY'S CANE-LOADING APPARATUS.

Pets in the Sea.

During a visit to one of the islands off the coast of southern California I found that the fishermen were in the habit of feeding certain wild animals, which in time became so tame that strangers might almost think they were domesticated. The fishermen fed the gulls every morning when cleaning their fish, some of the birds becoming so friendly that they allowed the men to touch them, while others followed them out to sea, alighting on their boats, and exhibiting remarkable confidence.

Among the animals which frequently came into the little bay to feed was a large seal. It sometimes followed fishing boats in, and once, when rows of fish were hung up to be photographed by their fortunate captors, it raised its head high out of the water, apparently eying the fish so eagerly that the boatman gave it a share.

The fishermen usually went gill fishing late in the afternoon, and the seal, perhaps conceiving that the whole operation was for its benefit, began to accompany them; and as soon as a fish became entangled it would dive down and take it out of the net, returning to the surface to toss it in the air in high glee before the eyes of the fishermen. In this way the seal robbed the nets, growing bolder and bolder. At last, one day when one of the fishermen had returned from the banks and was washing his catch from a boat not far from the spot where the writer stood, splashing the big red fish to and fro, suddenly a large black form darted up from below, two black eyes looked at the amazed fisherman for a moment, and then the seal snatched the fish from his hands, and swam away amid the shouts of laughter from the lookers-on.

A few days later, presumably the same seal appeared off the wharf where several anglers were fishing, and deftly carried off their bait without being hooked. In the latter sport the seal was joined by a black diver —a bird with a long, snakelike neck and pointed bill —which was as much at home beneath the water as above, and which watched the fishermen with eager glance. The moment the bait struck the water, the bird plunged beneath the surface and seized it. Finally it was hooked and hauled ashore—an operation that did not prevent it, on being released, from renewing the pilfering on the following day.

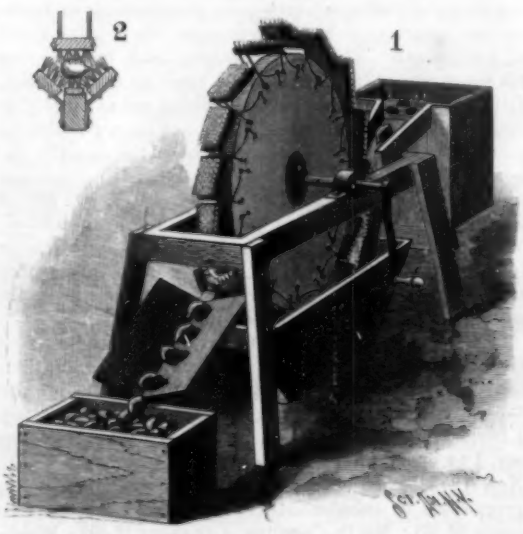
A fisherman on the Maine coast once claimed to own a remarkable pet, though it must be confessed that the question of proprietorship was open to doubt. The man was in the habit of fishing about ten miles offshore on what was known as the cod banks, and often took fish of little use, which he tossed over. One day he noticed a tunny playing about the boat, and tossing a dogfish at it, he was surprised to see the big fish turn and seize it. Wishing to see how near the fish would approach, he threw another, bringing the tunny within a few feet of him. On another day he saw what he assumed was the same fish in the same locality, and fed it again, repeating the act until the fish displayed no fear, and finally approached to the very side of the boat. The writer once had a number of singular pets in the guise of loggerhead turtles. He had led an expedition to capture them on Loggerhead Key, about seventy miles from Cuba—a locality somewhat remarkable for the animals—and gradually they had accumulated until nearly a dozen were living in an inclosure about sixty feet wide and an eighth of a mile long, into which the sea water flowed freely.

It was desirable to learn whether the turtles were susceptible to the taming process; so a system of education was begun that was fruitful of some exciting episodes. The turtles, when not feeding, lay at the bottom in water eight or ten feet deep, their huge bodies plainly outlined against the sand. Here they undoubtedly slept or dozed, and it was comparatively an easy matter to swim down and grasp them from behind by the back of the shell just over the head. The moment the turtle felt the grasp it bounded to the surface and took a long breath, then dived again, dragging the rider along at a rapid pace, now under water, again at the surface, endeavoring in vain to shake off by desperate plunges the enemy, who, like the old man of the sea, clung closely to its back. If the turtle had been left to its own devices, it would soon have escaped; but, by placing the knees upon its back, enough resistance was brought into play to force it to the surface, and after a number of rushes up and down the inclosure it was reduced to submission. This experiment was tried many times with a view to domesticating the huge loggerheads, who finally apparently submitted with some degree of grace to the daily exercise, and would gather at one end of the inclosure to be fed.

The strength of these reptiles was marvelous. Not only could one of the largest size tow a man through the water and beneath it, but when two were fastened in a rude canvas harness and attached to a flat boat they towed it around for an indefinite period; and when the first fright was overcome, they swam along nonchalantly, as though they rather enjoyed it.—By C. F. Holder in The Outlook.

A MACHINE FOR WASHING ORANGES, LEMONS, ETC.

A machine especially adapted to thoroughly clean the rinds of oranges, lemons, etc., without, in the slightest degree, injuring such fruit, is represented in the illustration, the fruit being fed into the machine at one end and delivered at the opposite end in a thoroughly cleansed condition. The improvement has been



WRIGHTS' FRUIT-CLEANING MACHINE.

patented by Benjamin B. and James H. Wright, of Riverside, Cal. The fruit is first placed in a water trough at one end of the machine, to loosen any foreign adhering matter, and is then passed down the feed trough beneath the brushes of a wheel revolved by a crank handle, the lower portion of the wheel passing through a rinsing tank. In this tank is a series of segmentally arranged brushes, between which and the brushes on the periphery of the wheel the fruit is passed, as indicated in the sectional view, Fig. 2. The brushes on the periphery of the wheel are supported by spring rods, whereby their pressure upon the fruit may be a yielding and flexible one, not liable to injure the rinds, and the fruit is passed out through a delivery spout at the opposite end of the machine.

German Technical Schools.

It is no small wonder that "made in Germany" is already the most familiar trade mark in the world, for the whole German people are being educated scientifically in the arts of industrial production. Nowhere in the world does manufacturing become so nearly a skilled profession as in Saxony, for in this small kingdom there are no less than 111 technical institutes; Prussia has 260 such schools, with over 12,000 pupils; 35 of the schools are for painters and decorators, 16 for tailors, 9 for shoemakers, etc., other trades having at least one school. The government appropriates $600,000 for their support and the various towns and cities give liberal subsidies, Berlin alone giving $70,000 per annum. Baden, with 1,600,000 inhabitants, spends $280,000 a year in technical schools. Hesse, with a population of 1,000,000, has 83 schools of design, 49 of manufacturing industries and many others for artisans of various trades. Bavaria and Würtemberg and other cities have similar systems.

THE ZEROGRAPH.

It seems to be de rigueur that a fantastic name should be given to new instruments destined to be brought to the attention of the general public. The zerograph does not merely write ciphers, but is capable of transmitting the same number of letters and symbols as any other type-printing telegraph. However, a fancy name seems essential in this case, for to call the instrument the Kamm type printer, when one of its most important claims to attention is the absence of clockwork, would have been a comical error.

The general appearance of the instrument is shown in Fig. 1. Its overall dimensions are approximately 18 inches by 20 inches by 17 inches high. The keys, 36 in all, are not arranged in alphabetical order, but those most often required, i. e., those letters placed near the center of a typewriter keyboard, are put at the extreme left, the figures and stops which are less frequently used being at the right hand side. The reason for this will be explained presently. The most interesting part of the instrument is, as usual, the synchronizing device, and its action will be gathered from the following description and a reference to Fig. 2. The keys, A, of which one is shown in the diagram, are connected to vertical pins, B, arranged in the arc of a circle at right angles to the plane of the paper. The center of this circle is the axis of an arm, D, termed by Mr. Kamm the synchronizing arm. Normally this arm is held at a fixed starting position to the left of the arc of pins by a catch, and when the catch is released the arm is capable of swinging through the arc of a circle just above the pins already referred to until it is stopped by one of these rising. The impulse is given to the arm by a dropping weight connected to it by a cord passing over a pulley. The instruments at the two ends have exactly similar weights and synchronizing arms, a screw adjustment being provided; by this means the space through which the impulse-giving weight drops can be varied, so that the speed of rotation at either end of the arm can be slightly altered if it is not in exact agreement with the other end. The weight acts on the spindle through a pawl, so that it only acts during the forward swing of the synchronizing arm. Two current impulses are sent to line, the first releasing the catch and starting the synchronizing arm, and the second stopping the arm when the letter comes in a position for printing. The types are mounted on flat springs in the arc of a circle corresponding to that of the pins and fixed to the same spindle as the synchronizing arm, and the printing is effected by a plunger pushed forward by the printing magnet, which presses the type against the paper tape. An ink ribbon is employed in the usual manner, this being continuous and passing over two ink pads on the circumference of two rollers.

The arm, D, carries two projections, F and G, moved by the magnet marked "synchronizing magnet" in Fig. 2. The projection, G, is arranged to engage with any pin, B, as soon as this is raised by depressing the corresponding key, A. The other projection, F, engages with a hook, C, attached to the armature of the "starting magnet," and this catch holds the synchronizing arm in its initial position until the magnet is energized. On depressing any key, A, a contact at H is made as the key moves down, closing the circuit of the starting magnet and allowing the synchronizing arm to start on its journey. The lever attached to the key also makes a contact between K and L, and the starting magnet closes a contact at J; it will be seen that these two contacts connect the line battery to line. The line current passes through the synchronizing magnet at the other end, the armature, M, is attracted, F is released, and the synchronizing arm at that end also starts. When the synchronizing arm at the sending end reaches the pin, B, of the letter required, it is stopped by the pin, and closes another local circuit energizing the "second contact magnet" and the printing magnet. The former of these lifts its armature,

Fig. 1.—THE ZEROGRAPH.

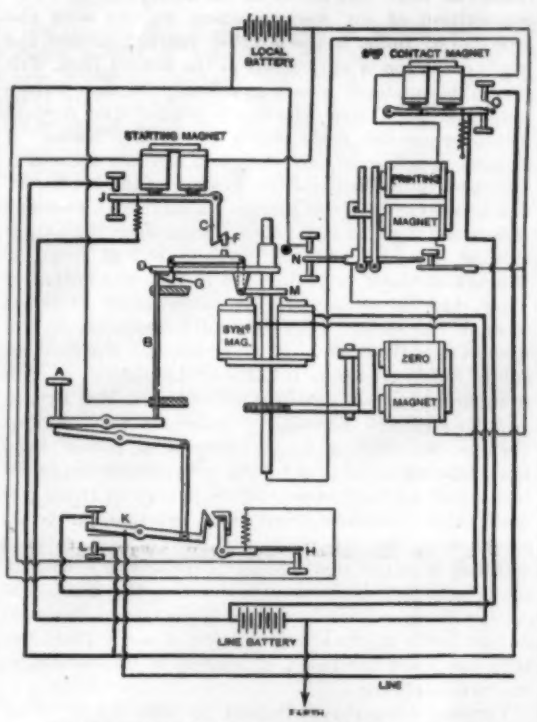


Fig. 2.—DIAGRAM OF CONNECTIONS IN THE ZEROGRAPH.

making a contact at O, and sending another current impulse to line. This second current again energizes the synchronizing magnet at the other end, the armature of which moves the projecting fang, G, so as to stop the synchronizing arm at the nearest spring-pin. This pin must correspond to that at the sending end of the line, if the two arms move with equal velocity. The same local circuit at each end is therefore closed, and the printing magnets press the type against the paper. At the same time the paper is fed by the usual mechanism, and the circuit of the "zero magnet" is closed at N, this magnet returning the synchronizing arm to its initial position. We believe that an arrangement of condensers and resistances are connected across the contacts in the local circuits, to diminish sparking.

In point of speed the zerograph, although not competing with the Hughes type printer, is, it is seen, far beyond instruments of the step-by-step type, of which latter the "telescriptor," described in the SCIENTIFIC AMERICAN of January 1, is an example. The synchronizing arm takes but half a second to swing to the limit of its travel and back; and as the letters most frequently used are placed to the left, at the first part of the range of the synchronizing arm the average time per letter is but a very small fraction of a second; in fact, it is claimed that the instrument can transmit 25 words a minute. As evident from the description, however, everything depends on the accuracy with which the speed of the two synchronizing arms agree; and although the spindles are mounted on jewels, and the instrument shows most careful and workmanlike finish, time only can decide whether in this important respect no trouble is likely to be experienced. We understand that experiments have been made on long artificial lines, but no actual trials on long telegraph lines. The synchronizing magnet is very sensitive, and a 12 milliampere current suffices to work it, but we should expect that on long lines with considerable distributed capacity some method of curbing will be found necessary to insure the first current impulse being completely wiped out before the second occurs. It is essential that each impulse should take the same time to reach the other end, but the time elapsing between successive impulses varies with each letter.

Mr. Kamm has also devised a "column printer," in which paper of a certain width is used instead of tape. To commence a new line a key is pressed which is not connected to any of the circle of pins, and the synchronizing arm swings right to the end of its travel, closing a contact there which completes the local circuit of an extra electromagnet. This magnet moves the paper forward, and at the same time brings it back to the commencement of the line. This type of instrument is, however, not beyond the experimental stage, so that a detailed description of it would be out of place now. For our engravings and the description we are indebted to The London Electrician.

AN ELECTRIC STREET RAILWAY SPRINKLER.

We present an engraving of an interesting trolley sprinkling car which is designed to sprinkle the streets from curb to curb. It is very essential in many of our wide streets and boulevards to sprinkle the entire width of the street at one operation, and the car which we illustrate does it very effectually. The sprinkling wagon of to-day is a great improvement over those formerly in use, on account of the ability of the driver to judge and determine instantly how much water to put on the pavement to sprinkle it properly and not flood it; but sprinkling with an ordinary horse tank wagon is expensive, owing to the fact that its capacity is small, requiring frequent fillings, and the cost of maintaining horses is very heavy. Many of our modern trolley lines are miles in length, and, with a car like that shown in the illustration, many miles of streets or roads may be sprinkled with economy and dispatch. The trolley sprinkler

THE MILLER ELECTRIC WIDE SPRAY SPRINKLING CAR.

has a capacity of 25,000 gallons of water, and by means of rotary electrically-driven ejectors the water is thrown out from the car to a distance of fifty feet if desired. The width of spray can instantly be reduced and at the same time the mechanism permits the varying of the quantity of the water discharged, so as to give the operator complete control of the spray and quantity of water discharged, so as to meet instantly any changes in the width of the road or the speed of the car, and the spray can be entirely shut off if desired. Both sides of the car are equipped so that it can move either end forward. The ejector consists of a four-roller gun metal rotary pump, with adjustable casing for regulating the flow of the water. The ejector is operated by an independent differential gear electric motor, and there is no connection between the movement of the car and the operation of the ejector. Two separate sprinklers of the ordinary kind are placed below the front and rear of the car for watering the space between the tracks. These are controlled by lock stops separate from those of the side sprays.

The car is fitted with two 35 horse power propulsion motors, the same as an ordinary electric passenger car, and can be run at any speed without interfering with the sprinkling device, which, on account of its adjustability, can discharge the same amount of water on the roadway irrespective of the speed at which the car is traveling. It will be seen that this sprinkling car is a radical departure from other devices for sprinkling streets. That it can be successfully operated in the largest cities and result in better service at a smaller cost per front foot will be easily seen.

We are indebted to the Miller-Knoblock Company, of South Bend, Indiana, for the foregoing particulars. This device is patented by William H. Miller.

Bessemer Steel and its Effect on the World.

The wonderful economic changes wrought by the introduction of Sir Henry Bessemer's inventions have never been more ably set forth in a few words than by the Hon. Abram S. Hewitt, in an address delivered before the Iron and Steel Institute, when the Bessemer Medal was conferred on him in 1890, for distinguished services to the iron and steel trade. We quote Mr. Hewitt's words in full:

"I do not propose to enlarge upon the practical application of the Bessemer process to the manufacture of steel: but, if you will bear with me, I think it would be well to direct attention to the effects of this invention on the economic, social and political condition of the world. A very few considerations will serve to show that the Bessemer invention takes its rank with the great events which have changed the face of society since the time of the middle ages. The invention of printing, the construction of the magnetic compass, the discovery of America, and the introduction of the steam engine are the only capital events in modern history which belong to the same category as the Bessemer process. They are all examples of the law of progress which evolves moral and social results from material development. The face of society has been transformed by these discoveries and inventions. It is inconceivable to us how the world even existed without these appliances of modern civilization; and it is quite certain that if we were deprived of the results of these inventions, the greater portion of the human race would perish by starvation, and the remainder would relapse into barbarism. I know it is very high praise to class the invention of Bessemer with these great achievements, but I think a candid survey of the situation will lead us to the conclusion that no one of them has been more potent in preparing the way for the higher civilization which awaits the coming century than the pneumatic process for the manufacture of steel. Its influence can now be traced, although the future results are still beyond the reach of the imagination.

Its principal characteristic is to be found in its cheapness. Steel is now produced at a cost less than that of common iron. This has led to an enormous extension in its use and to a great reduction in the cost of the machinery which carries on the operations of society. The effect has been most marked in three particulars: First. The cost of constructing railways has been so greatly lessened as to permit of their extension into sparsely inhabited regions, and the consequent occupation of distant territory otherwise beyond the reach of settlement. Second. The cost of transportation has been reduced to so low a point as to bring into the markets of the world crude products which formerly would not bear removal, and were thus excluded from the exchanges of commerce. The practical result of these two causes has been to reduce the value of food products throughout the civilized world; and inasmuch as cheap food is the basis of all industrial development and the necessary condition for the amelioration of humanity, the present generation has witnessed a general rise in the wages of labor, accompanied by a fall in the price of the food which it consumes. I think it would be a very modest estimate of the improvement in the condition of the working classes as a whole to say that in the essential elements of comfort the working classes of our day are enabled to earn and to expend at least double the amount which was at their command in any previous age of the world. This result appears to me to be due very largely, if not altogether, to the economy in the agencies of production made by the cheap steel of the Bessemer process and of the other inventions which have followed in its wake. These are material results, but they are accompanied with the slow but sure elevation of the great mass of society to a higher plane of intelligence and aspiration. No better evidence of this can be afforded than the association of workingmen together for the advancement of their moral and social condition. Troublesome as the trade unions may have been, they indicate a step in advance which should be the subject of congratulation among all the well-wishers of the race. I see nothing but good to come out of the modern tendency to association, and I hold it to be one of the chief glories of Sir Henry Bessemer that he has contributed more than any other living man to that condition of industry which compels all who are engaged in its conduct to combine on a scale unknown before his time in the work of economic production and equitable distribution.

The first striking result in the cheapening in the cost of the production and transportation of food products was felt in Great Britain, which is now compelled to import at least two-thirds of its consumption. The competition of our western wheat regions with the products of India in the English market altered the whole condition of agriculture in the British Isles. The profitable raising of wheat practically became impossible, and the farmers who had depended upon it could no longer pay the rents stipulated in their leases. A general reduction of rent, therefore, became necessary, which of course reduced the income of the landlords. The aristocracy of Great Britain is a survival of previous conditions, depending for its existence upon the ownership of the land and the revenue derived from it. Hence a serious if not fatal blow at the domination of what may be termed the privileged class of Great Britain was struck, unintentionally, doubtless, by the invention of Bessemer. We have not seen the final result of the competition it has introduced, but enough is apparent to show that the structure of the British government will necessarily undergo very serious changes, all tending to the transfer of power from those who own the land to the commercial, manufacturing and working classes of the people. I think it is doubtful whether any event in modern times, of equal significance, has occurred. Sir Henry Bessemer has certainly been the great apostle of democracy, and although he may be inclined to disavow the claim, history will record the fact that he has been the most potent factor in the reconstruction of the British Constitution upon the basis, ultimately to be reached, of universal suffrage.

Turning from Great Britain to this country, the effects of the Bessemer invention have been even more pronounced and striking. The cheapening in the cost of transportation enabled us to increase enormously the sales of food products in foreign markets. In accordance with the well-known law of commerce that a nation cannot sell without buying, our imports of foreign merchandise have been increased in a corresponding degree. Under our fiscal system, made necessary by the war for the Union, a revenue has been derived enabling us to reduce our national debt in twenty-five years from about four thousand millions of dollars to less than nine hundred millions of dollars at the present time, notwithstanding the payment of a pension roll which now amounts to fully one hundred and twenty millions of dollars per annum. We can trace, therefore, directly to the Bessemer invention the ability to reduce our national debt, and finally to pay off the outstanding bonds at maturity. This proposition can easily be verified by examining the results of the operation of our railroads, by which it will appear that since 1870, when Bessemer rails began to be largely used, the rate of transportation has been reduced about two-thirds, and an eminent authority has recently stated that the difference in a single year would now amount to one thousand millions of dollars, a very large portion of which is directly traceable to the greater durability of the track, due to steel rails and the capacity to haul increased loads, not only in the cars but in the train. I doubt whether it ever occurred to Sir Henry Bessemer to consider the effect of his invention in furnishing us the means of paying off our national debt, but it certainly ought to secure for him the gratitude of every American citizen; and I am glad to have the opportunity, on this occasion, to bring this obligation to the notice of my countrymen.

The third point to which I would call attention is the vast extension and new direction of commerce which has resulted from the construction of steel vessels. The size of these vessels has enormously increased, and the cost of operating them has been reduced in a corresponding degree, comparing very favorably with the reduction of cost upon land, which is about one-third of what it was ten years ago. The characteristic of modern commerce is the rapidity with which exchanges are made, and in the fact that all portions of the habitable globe are quickly reached. The commercial world has been converted into a vast clearing house for the exchange of products. One country may sell more than it buys, or buy more than it sells, to a particular country, but the difference is counterbalanced by a corresponding sale and purchase from some other country. The balances are not paid in money, but are passed to the credit of each country in the general settlement which takes place in the banking centers of the commercial world. Thus the function of the precious metals is reduced simply to the payment of final balances, which in the course of any one year are small in amount. The economy in exchange thus effected is largely due to the improvement in transportation, made possible by the general use of steel, aided by the telegraph and particularly by the submarine cables which now reach every part of the civilized world. The interdependence of the human race has thus been increased, and the possibilities of hostile action by war diminished in a corresponding degree. The name of Bessemer will, therefore, be added to the honorable roll of men who have succeeded in spreading the gospel of 'Peace on earth and good will toward men,' which our divine Master came on earth to teach and to encourage."

When Mr. Hewitt was seen after the death of Sir Henry Bessemer, he stated by way of corollary that in 1897 the United States was the largest producer of iron and steel in the world, and that she would remain so. This will make her mistress of the export trade, of which we are now only on the threshold. We need not fear losing the primacy when once obtained, for it has been found that the Lake Superior ores are specially adapted for the Bessemer process, as they are low in phosphorus; this puts us ahead of all competition.

Psychic Development of Cats and Dogs.

Prof. Wesley Mills' experiments on the psychic development of young animals continue to be very interesting, says The Popular Science Monthly. In the kitten, while the first stages are very slow and obscure, the author finds that in the progress of all the senses to full development the course, while marked by definite steps, is often so rapid that distinct advances may be marked in a single day. Apart from the senses, etc., there seems to be a definite order in which all the features of feline nature appear, as, for instance, purring, crouching, stalking, etc. Certain physical changes are correlated in time with certain psychic developments, the significance of which is in some cases clear, in others obscure. Comparing the two animals, the cat, on the whole, develops more rapidly than the dog, the greatest difference between them appearing in the social and gregarious nature of the dog and the independent and solitary traits of the cat. The dog is docile in the highest degree; the cat to a slight degree, compared with its intelligence. The play instinct is early and highly developed in both, and the peculiar qualities of each are well exhibited in the manifestation of it. In will power and ability to maintain a separate existence the cat is superior to the dog. In the higher grades of intelligence the wisest dogs are much in advance of the most knowing cats; and this is foreshadowed, if not exemplified, in the early months of existence. The nature of the dog as compared with the cat tends to beget prejudices in his favor with the mass of persons, so that in general the dog is overestimated and the cat underestimated with the great majority; at the same time the dog's nature is much nearer that of man than the cat's. "The kitten may amuse, but even a puppy dog touches chords of sympathy in the heart of man that the cat can never reach."

The Current Supplement.

The current SUPPLEMENT, No. 1160, contains a number of articles of unusual interest. The complication of the United States, Cuba and Spain is touched upon in three articles: The 'Naval War Game," "The United States Buys the 'Mayflower,'" and "Alphonso XIII., King of Spain." All these articles are illustrated. The "War Game" is of particular interest, in view of the fact that the question of a naval fight between Spain and the United States is taken up, and models of the vessels of the two navies are pitted against each other. "Prehistoric Bronze" is the subject of an interesting paper by R. L. Packard, of Washington, D. C. The "Reduction in Cost of Steam Power from 1870 to 1897," by F. W. Dean, gives important figures showing the cost of steam power to-day and twenty-seven years ago, and demonstrates the remarkable changes which have been introduced by improved methods of generating and consuming steam. "An Electrolytic Process for the Manufacture of Parabolic Reflectors" describes an ingenious electrical process for coating mirrors for reflectors for search lights and similar purposes. The "Phonendoscope," an instrument for ascertaining the state of the organs in the human anatomy by means of the ear, is described more fully than heretofore. The "Report of the Commissioner of Patents for 1897" deals with the condition of the Patent Office to-day, and the first installment of this report is published in this week's SUPPLEMENT.

Correspondence.

Acetylene Gas Generators.

To the Editor of the SCIENTIFIC AMERICAN:

I have been greatly interested in your articles upon acetylene gas, and have some of your SUPPLEMENTS describing generators for same. Having just constructed a generator with small gas holder for my own use, I would like to inquire of you if they really are dangerous to use, as I have just received a small pamphlet asserting that they are. CHARLES WITNEY.

Santa Cruz, Cal., March 1, 1898.

[There is real danger in using acetylene; there is real danger in using dynamite; there is real danger in using any combustible gas. But, the danger in using acetylene is one of pressure and explosive mixture. If the generator is tight, does not leak, does not get hot enough to turn the water into steam, works at not over 20 pounds pressure (4 inches of water being sufficient for house burners), contains enough water, has no open flame near it (light should come through a pane of glass in the partition), never allows the pressure to get so high as to blow out the flame, if the carbide can is not left standing around open (a lighted cigar or pipe will explode acetylene air mixtures) and the lime removed outside, we think there is no danger. Wet generators are popular in Europe, especially for large plants.—EDS.]

The Cotton Crop of 1896-97.

A circular issued by Statistician Hyde of the Agricultural Department gives some information concerning the cotton crop of 1896-97, its value, the amount purchased by mills and the acreage planted, says Bradstreet's. The proverbial slowness of government publications is well exampled thereby, because for nine months the succeeding crop, that of 1897-98, has monopolized the attention of the trade. It shows that the total cotton crop of 1896-97 amounted in commercial bales to 8,532,705, made up by the following States: Alabama, 833,789; Arkansas, 605,643; Florida, 48,730; Georgia, 1,299,340; Indian Territory, 87,705; Kansas, 61; Kentucky, 414; Louisiana, 567,251; Mississippi, 1,201,000; Missouri, 24,119; North Carolina, 521,795; Oklahoma, 35,251; South Carolina, 936,463; Tennessee, 236,781; Texas, 2,122,701; Utah, 123; Virginia, 11,539. It is stated that the large and increasing amount of raw cotton taken directly from the current crop by mills from the cotton-growing States is more than ever an important factor in estimating the annual production. Ten years ago only about six per cent of a crop of 6,500,000 bales was used by those States, while during the year 1896-97 they used over 11 per cent of a crop of over 8,500,000 bales. The number of mills in operation during the year was 402, the number of spindles 3,344,327, and the number of bales bought 981,991. The investigation of the production of Sea Island cotton shows that the crop of 1896-97 was the largest one on record, the States of Georgia, Florida, South Carolina and Texas having produced 104,368 bales. The next largest crop was that of the preceding year, estimated at about 93,000 bales. The production of Georgia was 64,668 bales; that of Florida, 26,431 bales; South Carolina, 10,769; Texas, 2,500. The total value of the uplands crop was $285,810,606, which gave an average of 6·65 cents per pound of that sold, and the total value of the Sea Island crop, $6,000,958, an average price of 16·58 cents per pound. The total acreage during 1896-97 was 23,273,369, the number of bales raised 8,532,705—an average of 0·37 bale per acre.

A Musical Wheel.

The bicycle has reached another phase of its constant development through a novel and highly interesting invention, consisting in a musical instrument which may be attached to any bicycle and plays popular airs, without the aid of the rider, in a loud and melodious manner, when the machine is in motion. This instrument constitutes an entertaining companion for the bicyclist on his roamings, which are frequently rather lonely; it is so much more welcome as it will be a companion entirely submissive to the rider's wishes. It has been invented, patented and placed upon the market by a firm in Hamburg, and is fittingly called "troubadour," after the wandering musicians of the middle ages. We had occasion recently to attend a trial ride in the Hamburg Zoological Garden with this new musical instrument, and cheerfully confirm the excellent effect produced. The director of the concern had the cycles provided with the new musical apparatus pass before us ridden by employes, and we heard a loud-sounding, well-timed music, after the style of the "herophone." This novelty is sure of great popularity among cyclists. It will also be beneficial in a hygienic respect, as excessively fast riding will be prevented. As a matter of fact, the music only sounds well when the rider does not exceed a velocity of 15 kilometers (9·3 miles) per hour. We will add that in future a sort of orchestra band may be formed for the popular cycle parades by means of these instruments tuned to the time. As is well known, the music has been the most difficult part of these parades.—Echo vom Gebirge.

Science Notes.

A Natural Hot Water Heating System.—Boise City, Idaho, is to pipe into its houses warm water of 170 degrees temperature from a subterranean lake 400 feet beneath the surface.—New York Evening Post.

According to The Electrical World, the value of the instruments and machinery exported from the United States during 1897 for scientific purposes was $3,054,453, which was an increase of half a million dollars as compared with the exports in 1896.

According to Petermann's Mittheilungen, there is a town of 60,000 inhabitants in Syria, not far from Latakia, in which there is not a single physician. The name of this unfortunate place is Hamah. As is the case with most of the towns in that country, diseases of the eyes are exceedingly common, and an oculist who is willing to rough it and to suffer many discomforts could doubtless gather in numerous shekels.

Herr Krupp, of Essen, has given 10,000 marks to the Berlin Geographical Society for a gold medal to be awarded yearly for geographical discovery. It will be called the Nachtigal medal, after Krupp's friend, Gustav Nachtigal, the African explorer, and, where merits of candidates are otherwise equal, will be given in preference first to discoveries on the African continent and next to exploration in Germany's colonies elsewhere.

In the twenty-three libraries of Berlin which are either public or belong to official bodies there are over 2,000,000 volumes. The royal library contains over 1,000,000 volumes, the university library 158,000, that of the royal statistical bureau 136,000. The war academy collection consists of 88,000 volumes, that of the general staff of 69,700, and that of the royal chancery 72,600 volumes. The twenty-seven city libraries have only 76,000 volumes between them.

A. A. Noyes and W. R. Whitney claim to have experimentally established the law according to which solid substances are dissolved in their own solutions, and they express it in the following terms: "The rate at which a solid substance dissolves in its own solution is proportional to the difference between the concentration of that solution and the concentration of the saturated solution." This law has been proved to be correct in the case of substances so widely differing in chemical nature and physical properties as benzoic acid and lead chloride, and it is therefore assumed by the authors to be of general application.—Jour. Am. Chem. Soc.

A photographic method of measuring the height of a balloon, and at the same time comparing the results with those furnished by barometric readings, is described in La Nature for January, by M. L. Cailletet. The apparatus consists of a camera with one lens pointing downward, by means of which a photograph of the country below the balloon is taken; at the same time a lens at the top of the camera projects on the upper side of the sensitized film an image of the dial of an aneroid barometer placed above the apparatus. By measuring the distance between any two points on the photographic view, and comparing with a map of the district, the altitude of the balloon can be accurately found, and the law connecting it with the barometer reading verified experimentally.

Lindemuth suggests that it may be possible to produce variegated specimens of almost any species of plant by grafting upon it a form with colored leaves, not necessarily of the same species, but of a nearly allied form. It is found that if a variegated form of one species be grafted upon a normally colored plant of another, the green plants produce variegated shoots. Thus a green plant of Malvastrum capense on which a variegated abutilon had been grafted produced variegated shoots below the graft; vice versa, a green plant of Kitaibelia grafted on a variegated abutilon became variegated and gave vigorous cuttings, which, when grown in the open, remained variegated. Althea officinalis when grafted on the same abutilon also became varigated. Petunia hybrida grows vigorously if grafted upon Nicotiana glauca.—Gard. Chron.

The reports of the asylum at Cairo as to the native patients there exhibiting the nature of the mental disturbance associated with the excessive use of hashish show some remarkable facts. It appears that in 41 per cent of all the male patients hashish alone or in combination with alcohol caused the mental symptoms, while this was the case with only 7 per cent of the females. As to whether there is a special recognizable form of mental disturbance produced by hashish, authorities conclude that, in a considerable number of cases in Egpyt, the hashish is the chief if not the only cause of such mental disease. The usual types of the disease are hashish intoxication, that is, an elated and reckless swaggering state, with optical illusions and hallucinations. Acute mania is another form of hashish insanity, involving terrifying hallucinations, restlessness, sleeplessness, incoherence and exhaustion; again, this kind of insanity takes on the form of weak-mindedness, the patients being quiet and well behaved, but overtalkative, easily pleased, excitable about small things and unconcerned as to the future.

Recent Archæological News.

Golf links have been opened on the grounds of the Villa Pamphili-Doria, Rome.

Themistocles' grave has been discovered by a Greek named Dragatsis on Cape Krakari. Its authenticity, however, is not beyond doubt, though the place where it was found fits in with the descriptions of Plutarch and Diodorus Siculus.

Mr. Bernhard Berenson is engaged in the very laborious task of sifting and cataloguing all the drawings by the Florentine painters, with authentic criticism and appreciation. The illustrations will consist of about two hundred facsimiles. The book will be printed in Berlin at the Imperial Press, and published in London by Lawrence & Bullen, probably next year.

M. Eugene Müntz, in a letter to The Athenæum, describes a torso of Minerva of Pentelic marble which was acquired by the Museum of the Ecole des Beaux Arts in 1841. It came originally from the Villa Medici at Rome. Herr Fürtwangler believes it was made for the eastern pediment of the Parthenon, from which the other sculptures went to the British Museum. It seems quite possible that Rome, as well as London, laid hands on many Athenian masterpieces.

Of more than ordinary literary interest is a book issued by a Leipsic firm under the title "Tabubu," being a close translation by Leon Ritter of an Egyptian papyrus found in 1864 by the late Brugsch Bey in Thebes. The original is in demotian script, and some leaves of the manuscript were missing when first discovered. The story is not only very entertaining, even in the modern sense, but it is also peculiar in furnishing proof that the Faust problem was known to the Egyptians several thousand years ago.

At Trieste the important discovery has been made of a Van Dyck. This canvas of the celebrated Flemish painter represents a young princess of the ducal house of Gonzaga of Mantua. The history of this Van Dyck is sufficiently curious. In the month of September of the year 1628, on the death of Duke Vincent II., Mantua was taken by the German troops. The imperial army was largely composed of deserters, who made no delay in sacking the place. All the objects of art, sculptures and paintings which the Gonzaga family had accumulated in Mantua were carried off by the German reiters, and among them was this painting by Van Dyck. After many adventures, too long to enumerate, it was stranded at Trieste, where it has just been found.

At a recent auction sale in London the authentic remains of Ptolemy II., King of Egypt, Antiochus Soter, King of Syria, and Alpina, Queen of Babylon, went under the hammer. The royal party were inclosed in a three-partitioned, glass-fronted case. They looked somewhat battered after 3,000 years of retirement, but Ptolemy, whose physique was the finest, was complete. Antiochus was perforated with small holes and his right arm was lying at his feet. Alpina retained a matted and dusty remnant of her raven tresses, but her eyes had suffered sadly, looking as though she had been engaged in unqueenly fisticuffs. The auctioneer presented the distinguished trio with letters of introduction from antiquarians and a recommendation, but refused to be personally responsible. He encouraged possible purchasers by pointing out the notoriety which must ensue from having their names sent all over the world, and dwelt upon the handsome living made possible by traveling with the mummies, giving exhibitions to countless spectators. Despite such allurements, bids were not forthcoming until the auctioneer himself started the bidding at $50. Finally the lot fell for $375 to a dealer of the name of Cross, of Liverpool.

A discovery in Rue du Cloître, Notre Dame, Paris, the street along the left side of the cathedral from the parvis, is likely to modify some of the theories about the history of the site, says The London Architect. Cæsar speaks of Lutetia as "the fortress of the Parisii placed on an island of the river Sequana," and the earliest settlement would therefore appear to be on the island of which Notre Dame occupies a part, and for a long time was confined to it. A bishop's church was founded there about A. D. 365, which supplanted a pagan temple. In the excavations on the sites of some houses which were demolished in the Rue du Cloître, at about 16 feet below the surface, remains of a wall 9 feet thick have just been discovered. The question arises, was the wall a part of the ancient temple or of a different building? The stones are apparently Roman work, for Roman names are roughly cut on them. But the masonry appears to have formed part of an amphitheater, another part having been discovered in 1847 beneath the parvis or open space in front of the cathedral. The discovery is so recent the French archæologists cannot be expected to explain it forthwith. M. Sellier says it is a portion of the Gallo-Roman wall of the ancient site, but apparently Notre Dame stands on the arena of an amphitheater rather than on the site of a temple, unless the stones were removed from the amphitheater at the Rue Monge to form a defense against invasion.

THE CONNING TOWER OF THE GUNBOAT "HELENA."

The "Helena," recently ordered to Key West, is a light draught unarmored steel gunboat, one of two sister ships, contracts for which were placed with the Newport News Shipbuilding and Dry Dock Company. The ship was especially adapted for service on the rivers of China, and was originally intended for the Asiatic station, whither she was proceeding by the Mediterranean route when directed to remain at Lisbon until further orders. There were at that port also the "San Francisco" and the "Bancroft," the three vessels composing our European squadron, when, on March 12, the Secretary of the Navy ordered the "Helena" and the cruiser "Bancroft" to Key West. The "Helena" left Lisbon on the 14th of March and reached Funchal, Madeira, on the 16th. Especial interest has been attracted to the movements of these vessels from the fact that the Spanish torpedo boat flotilla sailed from Cadiz on March 13, for Porto Rico and Cuba.

The "Helena" is 250 feet 9 inches long on the load water line, with an extreme breadth of 40 feet $\frac{11}{12}$ inch, and draws 9 feet of water. She is driven by twin screws, actuated by vertical triple expansion engines, which give her a speed of 16 8 knots. Her complement of men is 10 officers and 165 men. Her main battery comprises eight 4-inch rapid firing guns. Her secondary battery comprises four 6-inch and four 1-inch rapid firing guns, 2 Colts and 1 field gun. She carries a fighting mast of very peculiar type, as it carries a conning tower some 40 feet above the water line.

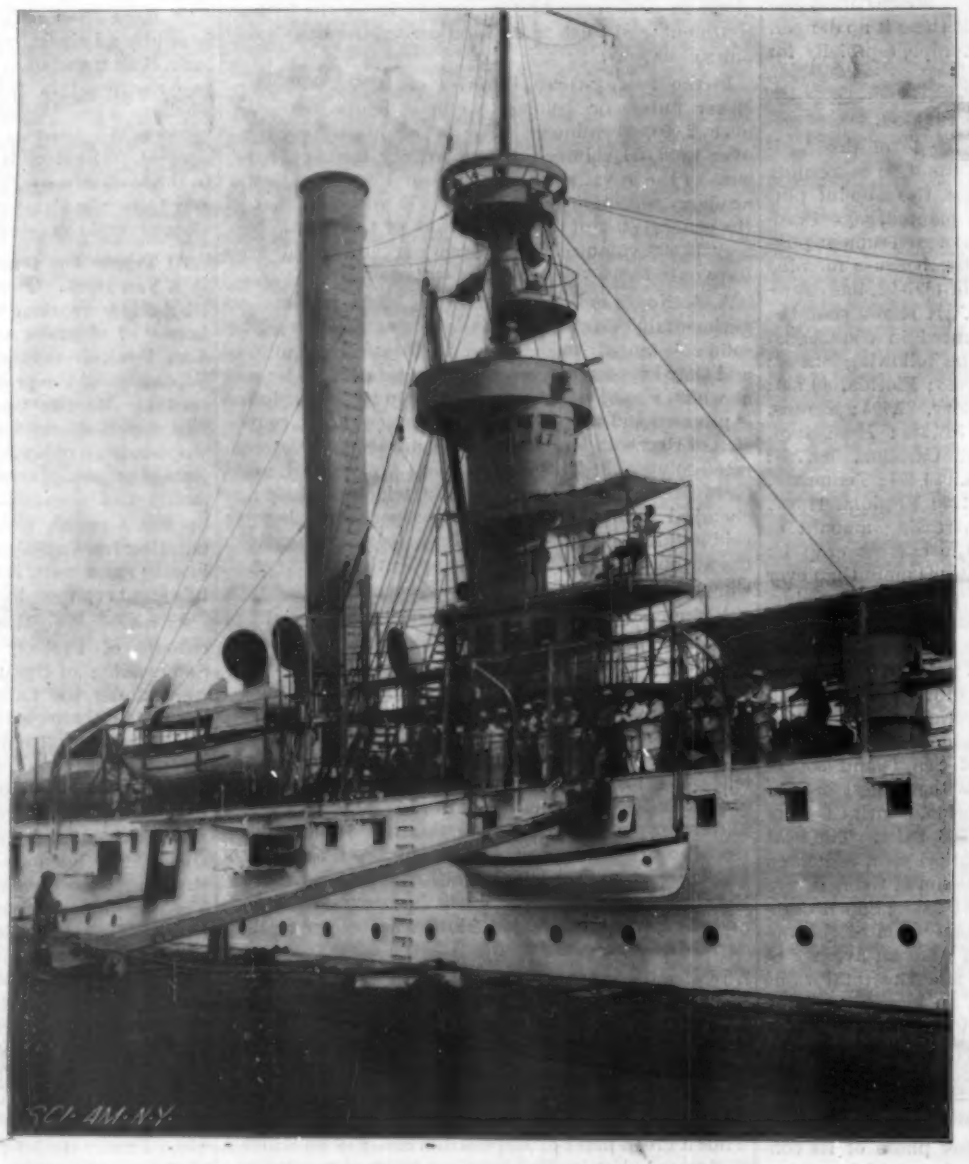
The ship was always designed to be available on the rivers of China. While she was being planned a Japanese officer happened to see the plans and he suggested the utility of a conning tower of sufficient elevation to overlook the banks of the Yellow River of China, the Yang-tse-Kiang. These banks are so high that they exclude the view of the country from those on an ordinary ship's deck. The Navy Department acted on the hint and our cut shows the result.

The fighting mast is composed of an outer and inner tube. The outer tube is 6 feet, the inner tube is 2 feet in diameter. A spiral staircase winds around the inner tube and gives access to the conning tower. Immediately below the lower top and partly supporting it is the tower.

This is carried on a sort of sponson on the mast. It contains a steering wheel and all appliances for communication with the different parts of the ship. The windows have hinged shutters with small openings. The metal of the conning tower is but $\frac{3}{8}$ inch thick. In it, from a height of nearly 30 feet, the commanding officer can overlook the obstacle presented by the high banks of the river, and can observe the enemy's actions to great advantage, should an inclination be shown to attack the ship.

The inner mast tube rests upon the berth deck, its lower open end projecting a few inches below the same. Thence it runs to the upper top. It contains an ammunition hoist. Seven and a half feet above the berth deck is the main deck, and on this the outer 6-foot mast tube is carried. Above the upper deck the mast passes through the chart house and pilot house and above all this comes the conning tower. The after portion of this is coincident with the 6-foot mast tube. The tower has an extreme width of 6 feet. Its length fore and aft is 10 feet.

Upon its top is the lower fighting top, in plan a circle of 14 feet diameter. Its weight is partly carried by the conning tower. Access to this top is had by foot rounds atttached, ladder fashion, to the outside of the 2-foot mast tube. The spiral stairs stop when they reach the floor of the conning tower. The 2-foot tube, still rising, carries the electric light top, and above this a fighting top, a 6-foot circle, with a 10-foot ring bracketed above the top and concentric with it. From the center of the upper top the signal pole rises nearly 28 feet further.



THE CONNING TOWER OF THE GUNBOAT "HELENA."

COLUMBIA UNIVERSITY.

Morningside Heights, whose lofty plateau is crowned by the stately buildings of Columbia University, is undoubtedly the noblest site that could have been chosen for the future home of this historic seat of learning. Nature and art have conspired to render the spot at once commanding and picturesque, and history has enriched it with memories which will forever appeal to the hearts and stimulate the patriotism of the alumni who throughout successive generations will frequent the halls of New York's famous University.

The new buildings of the University will form the central and dominant group of a collection of noble edifices, academic, ecclesiastic and commemorative, which will render the Heights, architecturally speaking, the Acropolis of New York. The imposing pile which forms the home of the college library looks down upon the great metropolis of the New World with something surely of the same pride with which the Parthenon of old surveyed the ancient Athenian city.

We have spoken of the historic associations of the site. It is scarcely necessary to remind the reader that the buildings stand upon the ground where the battle of Harlem was fought on September 16, 1776, as recorded in a dispatch from General Clinton to the New York Convention, announcing the success of the American troops. The facts are recorded on a tablet which has been placed on the walls of one of the college buildings.

The foundation of Columbia College dates back to the year 1754, and one of the most treasured relics in the Library building is the original college charter. This is preserved in a glass case let into the wall of the trustees' room, at the left of the fireplace, just below the portrait of William Samuel Johnson, who was president of the college from 1787 to 1800. The panel in which it is contained will be noticed in our illustration of the trustees' room. The portrait above the fireplace is that of Samuel Johnson, the first president, who controlled the destinies of the college from 1754 to 1763. The larger portrait to the right of the mantel is that of Dr. Barnard, who occupied the presidential chair before the present incumbent, Mr. Seth Low. The first building occupied by the college was located on what was known as King's Farm, and King's College, as it was called, was erected on that portion of the farm lying on the west side of Broadway between Barclay and Murray Streets, the grounds reaching to the Hudson River. It was described at the time as being "in the skirts of the city."

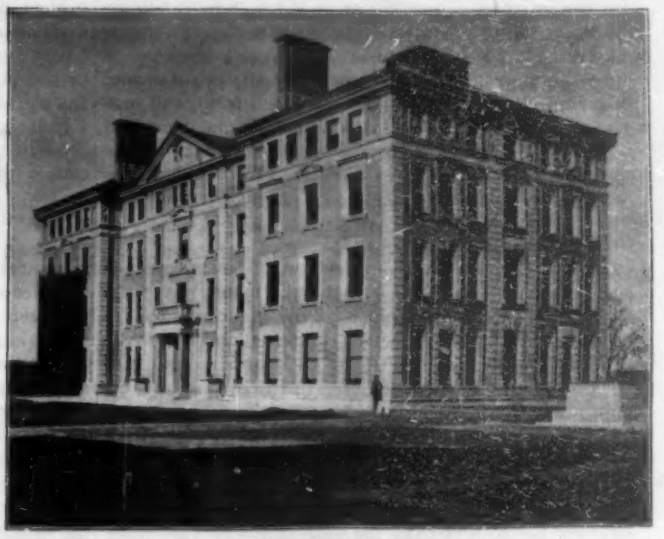
The new college, which was occupied in 1760, experienced many of the vicissitudes of the revolution, and did duty as both a barracks and a hospital. On May 1, 1784, the State Legislature passed "an act for granting certain privileges to the college heretofore called King's College, for altering the name and charter thereof and erecting an university within the State." The college now took the name "Columbia." In 1857 the college moved to the buildings purchased from the Institution for the Instruction of the Deaf and Dumb, situated on Madison Avenue, between Forty-ninth and Fiftieth Streets. These premises were enlarged or improved from time to time during the next forty years, or until the year 1897, when the University removed to the present commodious site on Morningside Heights.

The University grounds are bounded by One Hundred and Twentieth Street and One Hundred and Sixteenth Street on the north and south, by the Boulevard on the west and Amsterdam Avenue on the east, and they comprise some seventeen acres of land. The southerly ten acres of the ground are level, standing about 150 feet above the Hudson River, and it is here that the buildings of the University are located. The central and most imposing building of the group is the Library. It is approached from the south by a vast court 375 feet in width and 200 feet deep. From the court two flights of steps lead to the general level of the central and side courts of the buildings, and from this a noble flight of 22 steps carries the eye up to the great portico of the Library building. This superb structure, which is the gift of the president in memory of his father, Abiel Abbot Low, was erected at a cost of $1,250,000. It is built in the form of a Greek cross and the style is pure classic. The extreme width of the building is 192 feet and the height to the summit of the dome is 135 feet. The basement is built of Milford granite and the building above this is of Indiana limestone.

Entrance is had through a lofty portico supported by ten massive but symmetrical Ionic columns, whose largest diameter is 4 feet and their clear height 35 feet to the top of the caps. In the frieze of the cornice is inscribed "The Library of Columbia University," and the dates 1754 and 1897, and in the large panel above are inscribed the leading historical facts which we have already mentioned in this article. On entering the vestibule one gets the first glimpse of the great rotunda of the reading room, beyond the massive pair of Connemara marble columns which are seen to the left in our picture of the hallway or corridor. These two columns alone cost $10,000, and they are built of the largest blocks ever turned out at Connemara, the weight of each column being 25 tons. Indeed, it was only the unavoidable delay in furnishing the marble that prevented the use of this material for the sixteen columns which support the galleries in the rotunda. The main reading room beneath the dome is octagonal in plan, the short diameter being 75 feet and the longer diameter 85 feet. The four shorter sides form the piers for four great semicircular arches of 50 feet span which assist in carrying the dome. In the arches are large semicircular clerestory windows which serve to light the interior. Below the springing of the arches are the galleries, whose inner support consists of sixteen extremely handsome dark green marble columns. These columns, as well as those in the vestibule, are surmounted by capitals of solid bronze, each of which weighs nearly half a ton and is heavily plated with gold. The lower half of a set of these columns is shown in the bird's eye view of the reading room. The railing of each gallery is provided with four pedestals for the reception of classic statuary. A statue of Demosthenes is already in place, and in the same bay will be others of Pericles, Cicero and Julius Cæsar.

The dome is a meritorious piece of constructive work. It consists of an outer dome of brick and limestone and an inner false dome of steel framing and plaster. The outer dome is struck on a 52 foot radius. It is 4 feet thick at the springing and tapers in thickness to 9 inches at the crown. The thrust of the dome is taken

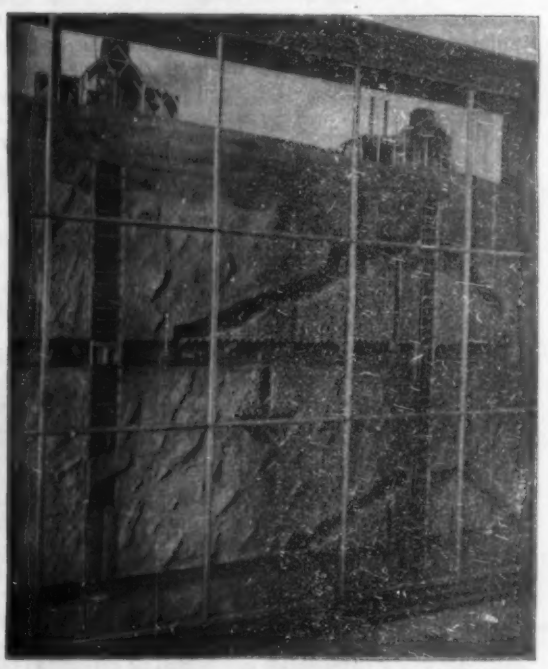
TRUSTEES' ROOM.



HAVEMEYER HALL.

PROF. KEENER IN HIS STUDY.

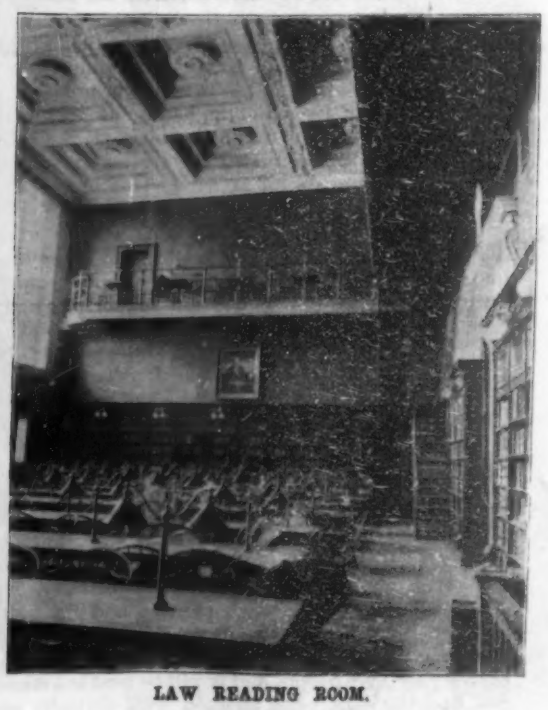
READING ROOM, LOOKING DOWN FROM THE GALLERY.



MINING ENGINEERING—MODEL MINE SECTION.

THE AVERY TABLET.

HALLWAY. LIBRARY.



LAW READING ROOM.

COLUMBIA UNIVERSITY.

by two great bars or straps of steel 1 inch in thickness by 12 inches wide, and the tendency to deformation is also resisted by the weight of several encircling steps of heavy masonry. About 16 feet below the dome proper is a wonderfully light false dome which forms the ceiling of the rotunda. The ribs of this dome consist of 2½ inch inverted T-irons spaced 4 feet apart at the springing, upon which are laid 1 inch by 1 inch angles and a covering of iron lathing. The plaster is laid directly on the lathing, and the ceiling thus formed is tinted a deep blue.

The lighting of the upper portion of the rotunda is accomplished by a large suspended "moon"—a plain wooden sphere painted white. This is illuminated by powerful concealed projection lanterns, and the effect is a soft reflected light thrown without shadows into the dome and the upper galleries of the rotunda. This method of illumination will be treated of in a subsequent article.

By reference to the illustrations it will be seen that the reading desks are arranged concentrically about a central circular book rack. Book shelves also fill the spaces between the columns and the walls of the four galleries. The volumes in these shelves will be chiefly reference books. Others are stored in the various rooms in the wings of the building, and the bulk of the library is in the great stack room in the basement below. Altogether, provision is made for 1,000,000 books.

It is impossible within the limits of this article to refer to the various divisions of this noble building in detail, but special reference must be made to the Avery Architectural Library, in the east wing, and the Law Library, in the north wing on the first floor. Each of these rooms measures 50 feet by 65 feet. The west wing is occupied by the periodical room, the catalogue and delivery room, and on either side of the vestibule are the trustees' room and the president's public office.

The law school has 360 students in attendance and its library contains some 25,000 volumes. It occupies the whole north wing. One of our illustrations shows the dean of the law faculty, Prof. William A. Keener, in his private study. In addition to the law library this school has at its service a lecture room seating 355 students, "club courts," a "social center" room and various studies and smaller rooms. The schools of philosophy and political science are also located on this floor. Mention must be made of the "seminars," which are large book stack rooms, which by sliding doors can be split up into smaller rooms, each room connecting with its own set of stacks. The third floor contains two lecture rooms of 188 chairs, one of 240 chairs and seven smaller lecture rooms of from 35 to 58 chairs.

Before leaving the Library we must speak of the unusual excellence of the furnishings, an excellence which characterizes the whole group of buildings. These are, without exception, of the best quartered oak and they are remarkable alike for their solidity, good taste and beautiful wax finish.

Next in importance to the Library Building and exceeding it in size is the truly enormous University Building, which is situated at the point where the grounds begin to dip toward Manhattan Valley on the north. It is only partly built, the basement and subbasement alone being at present erected. When it is completed, it will be the largest university building in existence. It will cover a plot of ground 180 feet in width and 260 feet in length, and will be rectangular in plan, with a semicircular northern end. The subbasement will contain a semicircular swimming pool 100 feet in diameter and 9 feet deep in its lowest part. The area surrounding the pool will be paved with marble and the floor of the gymnasium above will be supported on two concentric rows of massive pillars of Vermont marble. The floor of the bath, the diving platform and the walls will also be in the same material. Behind the swimming tank will be smaller bathrooms and a rowing room in which to give the crews winter practice.

On either side of the building, handsome stairways of Tennessee marble lead from the subbasement to the basement, on which is situated the great semicircular gymnasium, which has an extreme width of 180 feet and a height of 35 feet from floor to ceiling. The floor is of fireproof construction: steel, brick and concrete. The under wood flooring is of white pine and above this is a flooring of yellow pine inlaid with mahogany. Twelve feet below the ceiling and supported partly from the columns and partly by suspension rods is a running track measuring nine laps to the mile, which is well banked and carefully padded. The center of the building on this floor contains a locker room with 1,500 lockers, and provision is being made for putting in 1,500 more.

We are indebted to Superintendent E. A. Darling for the following details of this remarkable building:

The main entrance on the south will have a Corinthian portico, supported by fourteen columns, each 4 feet in diameter and 32 feet in height. Surmounting the portico will be a pediment and entablature. The dining room will extend back 120 feet and its width will correspond to the width of the portico. It will be lighted by clerestory windows. It will provide seating capacity for 1,000 people, and it will be used as a memorial hall, the walls being adorned with portraits and tablets in memory of distinguished alumni. It will be finished in oak and stone after the manner of King's College, Cambridge, England. To the east and west will be private dining rooms, club rooms and cloak rooms for the use of officers and students. The dining hall will terminate in what will be the proscenium arch of the academic theater. The theater will be arranged in classic form, and, like the dining hall, will be finished in heavy oak and stone. It will resemble the Chamber of Deputies in Paris, both in its arrangement and finish. It will have a seating capacity of 2,500, which is greater than that of any theater in this city, with the exception of the Metropolitan Opera House. The basement is built of local stone and has a granite base and granite quoins, sills and lintels. The portico will be of Stony Creek granite. The part of the building above the upper level will be in the Italian Renaissance style and finished with Harvard brick and Indiana limestone.

With the exception of the Library, all the buildings of the University will be in the same Renaissance style as the university building and constructed of the same materials. It is evident, as one passes through the various museums, lecture halls and class rooms, that the style lends itself admirably to academic needs, notably in respect of the generous windows with which every room is provided.

In addition to the two great buildings already described, four others have been completed at the present date. These are Havemeyer Hall and the Engineering Building, which stand to the west, and Schermerhorn Hall and the Physics Building, to the east of University Building. Ten other buildings, about equal in size to the Engineering Building (which measures 55 feet by 150 feet), are to be added at a later date.

One of the most creditable features in the fine equipment of the university is the power house, located in the basement of the University building. Here we find two simple Allis-Corliss engines each of 150 horse power and two 75 horse power Armington-Sims compound engines. These are all direct connected to the dynamos which supply the whole university. Steam is furnished by ten batteries of Babcock & Wilcox boilers, and the fuel is brought up in front of the furnaces in small trucks running on a system of tracks, this being the well-known Hunt system of fuel handling.

From the power house one can pass by the tunnel which carries electric mains and steam piping to the great testing laboratory. This large vault is on the basement level and is located in front of Havemeyer Hall. It is 31 feet wide, 25 feet high and 210 feet long, and is divided into three sections. The eastern 65 feet will contain the five Worthington pumps with their accumulators—an equipment which is quite unique in laboratories of this kind. The second section, 84 feet in length, will be occupied by a large Allis-Corliss engine which compresses air in three stages to 150 pounds pressure. It is also arranged to drive a Dodge experimental rope drive, in which the various problems connected with the subject of rope driving will undergo a thorough investigation. This also is the first installation of its kind. The western section, 60 feet in length, will contain Baldwin's celebrated compound "Columbia." It is a 4-cylinder engine built under the well-known Vauclain patents, with cylinders 14 inches and 23 inches in diameter. The testing plant must make provision for 1,600 horse power, or 400 horse power per wheel.

Another novelty, as far as laboratory equipment is concerned, is an electric car equipped with Walker motors. In an alcove will be placed a complete Westinghouse brake outfit, such as is used on railroad instruction cars, and the laboratory will also contain two experimental Otto gas engines. Experimental work will also be carried out on an Otis elevator, which will be driven by two types of pump, a Worthington and a Quimby screw pump.

Havemeyer Hall, of which we present an illustration, is 80 feet in width by 210 in length. It was erected by his children as a memorial of Frederick C. Havemeyer. Like all the buildings in the grounds, it is six stories in height. In the west half of the subbasement and basement are the department of metallurgy, the laboratory, library and draughting room; and in the east half are the department of assaying, the chemical laboratory and furnace room. The three stories above this are given up to chemistry, and the whole of the fourth story to architecture. In the rear of the building is an exceptionally fine semicircular lecture room, seating 325 students. The lecturer's table or counter is equipped with gas, blast, vacuum, electricity, hot and cold water. He can get a current of 500 amperes if desired, and three electric lanterns, projecting on three screens, are at his disposal for purposes of illustration.

Schermerhorn Hall, the gift of Mr. William C. Schermerhorn, is a sister building to Havemeyer Hall. It is devoted to the natural sciences. It contains the museums, laboratories, etc., of the departments of botany, geology, mineralogy, and zoology. Its mineralogical collection is the largest of its kind in thecountry.

The adjoining Physics Building contains the departments of physics, astronomy, mechanics and mathematics. Fronting it across the great central court is the Engineering Building, to the adequate description of which the whole of the present article could easily have been devoted. In the subbasement are the electrical laboratory, the thermodynamic laboratory and those of ore dressing and mining. A fine dynamo room and a large ore dressing laboratory are conspicuous features in the basement, and the four floors above are given up to museums, lecture rooms, small and great, and the best arranged, lighted and furnished draughting rooms it has ever been our privilege to see.

The success of Columbia University, its future growth in learning, numbers and wealth, are amply guaranteed by the ambitious and generous efforts which are being made to promote the interests of the University. The group of buildings on Morningside Heights, moreover, is well worthy of the chief seat of learning of the metropolis of the New World.

Finding Gold in New York State.

So much has been said about Alaska and the glory of its Klondike that the Empire State has been for some time without a furor to equal it, and New York never likes to be outdone. Until recently, the only part New Yorkers played in the great chase for gold was the sending of parties to try their luck in that distant, frigid region; but now the Empire State has a well developed gold furor in the chase for the precious metal within its borders, and thousands of prospectors are excited by the finds in northern New York, and Hadley, Warren County, seems to be in the center of the territory now creating interest.

Hadley is a village on the shores of the upper Hudson, with a scant population and few industries, save a large paper mill, to keep it alive. For years it has been celebrated more for its picturesque situation in the foot hills of the Adirondacks than as a town of energy. But now it is awakening suddenly to the realization of recently discovered advantages. It is the place where most aggressive gold-seeking action has been taken, and is the center of the district in which claims have been filed covering a large area in Warren, Saratoga, Fulton, Essex, Washington and Herkimer counties.

If these assertions are doubted, one has but to visit the office of the Secretary of State and witness the number of claims which are being daily placed on record there. During the last few months the claims of those who would get rich quickly number no less than 5,000.

Among those who own land at the foot hills of the Adirondacks, and all through the great northern wilderness, there is more excitement than the public is aware of, and all the more strange is this when one considers that it was not supposed that there was an amount of gold in that neighborhood to be worth the work of extracting it.

There is now one mill established at Hadley, and it looks as though the next six months will find many others scattered throughout the several counties where finds have been made. Many are awaiting the results of the experiments now being made, and are uncertain about the process to employ in extracting the metal.

The gold in this section is found in a fine state, and adheres to the grains of sand. The difficulty has been to separate it from the sand by a process which is economical. At the mill at Hadley it is ground or pulverized into a fine powder, and the metal is then collected by the quicksilver process.

In some places the sand in which the gold is found is about twenty-five feet deep and at other points still deeper down. It is believed that the resultant yield will be equal to four dollars each ton passed through the crusher and treated. This certainly compares favorably with the Western mines, and this news has brought the people in droves to see the place where gold is being taken from soil which all along has been considered too poor even for the tilling or raising of live stock. A process which is to be tried is called the combination cyanide-chlorination method. The territory worked at Hadley extends about one and a half miles above and below the town. Above, on the high plateau, is located the hostelry known as the Wayside Inn, which is a favorite summer resort. The Sacondaga Mining Company has its mill near Hadley, and a little above the junction of the Sacondaga and Hudson Rivers is the spot considered the richest field so far found. It was at this point that the soil was so poor and the rent of the dwellings so cheap that the few remaining members of the Abenaki Indian tribe located because of poverty. Here they lived for many years in tents and latterly in dilapidated houses. Surprising must it be to realize that they had pitched their tents, in the search for a spurned location, upon a tract below whose surface gold exists in paying quantities.

For a long time operations were conducted as secretly as possible, but this only added to the curiosity of the neighborhood. Mr. Worden, of the Worden House, at Saratoga, is the president of the company located here. The mill is a building about fifty feet square and three stories high. It contains a sixty horse power boiler and a fifty horse power engine. As there are two mills now going up below the junction of the Sacondaga and Hudson, it shows that there is an established faith in the gold-mining enterprises of New York State.

CUYLER REYNOLDS.

THE TEREDO AND ITS WORK.

The *teredo navalis* is a mollusk belonging to the tubiferous bivalves. It has been from time immemorial, in all quarters of the globe, a subject of comment on account of its ravages in timber exposed to its attack. There are twenty-four species of the teredo, but the ship worm is the best known of these. Along the Gulf coast of the United States the worm has been carefully studied by the builders of railroads, and the students have been rewarded here more abundantly than those who have examined the subject elsewhere. In reality, the teredo is like the flexible-shaft boring machine. The *teredo navalis* is a natural reproduction of this instrument and is something more. Its long and flexible body terminates in cutting shells or bits, and is inclosed, for the sake of its protection, in a boselike shell, which reaches from the inferior extremity to within a very short distance of what is known as the head. At that point the muscles come into play and work the cutters or bit edges and drive them into the timber, cutting as small and as round a hole as any boring machine yet devised. It can change its course at any point, and has this advantage over the flexible shaft auger.

The teredo first appears in the egg, which is round, like a mustard seed, which comes from a whitish looking mass, just below the stomach of the teredo, about a quarter of the distance from the head to the tail, and the eggs are in number from one to three millions.

These eggs are laid at the beginning of the warm season in the spring, and are deposited from time to time until cold weather sets in. The eggs hatch in the water, and give out worms about $\frac{1}{25}$ of an inch long, and so small as to be almost invisible to the inexperienced observer. They swim about for a day or so in the water, apparently enjoying their brief time of adolescence, and then search for timber. They enter the timber by boring and cutting with the shells or cutters with which they are provided, and the entrance they make is so small that it can scarcely be seen.

The worm grows at about the rate of two inches per month, under favorable circumstances, and bores a hole to accommodate its increasing size. The length of the hole is an indication of the length of the teredo, for it attaches its smaller end to the entrance of its burrow, and pushes forward with the growth of its body. As it progresses, it deposits a coating of lime upon the sides of its cell, the deposit being thinner as the animal advances. The deposit, which is thick at the entrance, is merely a film at the head, where is collected a whitish fluid, which contains the lime secreted for making the lining of the cell and perhaps, also, for repairing the wear of the cutters.

The worm continues its progress for one or one and a half years and propagates and dies. It is said it reaches the length of ten or twelve inches. The largest authentically observed specimen was twenty-three inches long and five-eighths of an inch thick at the large end. When grown, the teredo seems to be a gelatinous worm, attenuated in shape, extremely delicate to the touch and tapering to a very small point. The anterior or large end has two bifurcations provided with horny stiles which close up against each other like shells.

These cutters are attached to a pair of strong muscles which operate very much like forceps or scrapers. The edges of the shells carry away little chips or fibers of the wood. The continued scraping makes the walls of the cell regular, and, in time, with the action of the water, polishes them smooth. The bore hole made by the teredo is generally straight, as the inclination of the worm is in the line of the grain of the wood, and is changed only when the course will project the teredo into the tunnel of some other borer or when the path leads through some knots or twists in the wood. The teredo avoids the burrow of its neighbor with great accuracy. There may be hundreds of worms living in the same cubic foot of timber, but they never cut across or into the cavities of their neighbors. Coming in contact during its boring with wood having obnoxious qualities, the worm avoids it by going around it, or it will back about one-third of its length and begin a branch tunnel, previously building a calcareous dam across the abandoned path of its tunnel. It will get within the least possible distance of its fellows and within a hair's width of the outside of the timber without breaking the division wall.

At the base of its cutters is the esophagus, or orifice leading into the stomach, in which can be traced the fine sawdust and chips, showing that the worm feeds upon such matter. This is more likely to be food for the worm than the debris of stone which the shell fish of the same group as the teredo have to swallow in the course of their operations. Whether the worm has a rudimentary brain does not appear to be known. It is almost transparent and its interior arrangements can be plainly seen when it is suspended in glycerine or alcohol. The smaller end of the teredo is attached to the cell lining by a membrane in the shape of a sleeve, which closes the entrance hole and prevents water from coming into the cell. This sleeve is provided with two long pointed filelike edges which protrude,

LOG EATEN BY THE TEREDO.

by muscular action, out of the aperture. This instrument is to aid in removing the rough parts of the wood by the worm and partly to protect it against other animals. Without some such protection, a rival of the teredo or some parasite would enter the tunnel and devour the inmate. The teredo having lived its life and having given birth to millions of young ones, closes the outer aperture with a coating of lime and dies. Very often death comes before the allotted time, for so many worms will enter a piece of timber as to eat it up. The whole community, having no further means of subsistence, dies of starvation. Logs have been found cut all to pieces and filled with worms, all dead. As may be judged from our engraving, which is a half tone of a piece of wood which has been eaten by the teredo, it is a very destructive animal to timber and many series of experiments have been tried to find a remedy for this voracious little monster.

DEATH OF SIR HENRY BESSEMER.

Sir Henry Bessemer, the inventor and metallurgist, died in London, March 14. The death of this great man brings a realizing sense of the importance of his contribution to the world, revolutionizing, as it did, many vast industries. The remarks of the Hon. Abram S. Hewitt on Bessemer steel and its effect on the world will be found on another page.

Sir Henry was born in Hertfordshire, England, in 1813. From his earliest youth he was fond of modeling and designing, and at the age of twenty he was an exhibitor in the Royal Academy. He had always a leaning toward mechanical pursuits, and when he was demonstrating to the French military authorities at Vincennes the results of his system of firing elongated projectiles from high smoothbore cast iron guns, Commander Minie said: "Such projectiles will be of little use if you cannot get stronger metal for your guns." This led Sir Henry to consider the possibility of extending his researches to the kinds of metal most suitable for artillery purposes. At first he did not have the least idea of how he was going to do it, as the science of metallurgy was not familiar to him; but he was not daunted, as he worked on the theory, which is sometimes a good one, which he formulated as follows: "I find that persons wholly unconnected with any particular business have their minds so free and untrammeled to view things as they are, and as they would present themselves to an independent observer, that they are the men who eventually produce the greatest changes."

He studied all the literature on the subject and visited large manufacturing concerns to judge of the defects of the methods then employed. He then began experimenting in London, and after a year he produced a cast iron almost as white as steel. He made a small gun from this metal, which he took to Paris and presented to the Emperor Napoleon III., who encouraged him to keep up his experiments.

Sir Henry continued his labors, taking out patents for each improvement, and at the end of eighteen months the idea struck him of rendering cast iron malleable by the introduction of atmospheric air into the fluid metal. His first experiment was made in a crucible in the laboratory. The samples produced were so satisfactory that facilities were offered him at the Woolwich Arsenal, and the first sample of "Bessemer" steel rolled was preserved by Sir Henry as a memento. He took out a patent embodying his idea in October, 1855. His experiments brought on a severe illness, and after his recovery he built a large experimental plant at Saint Pancras, London, with a converter three feet in diameter and five feet high. The classic trial rendered famous the premises once the home of Richard Baxter. The engine forced streams of air under high pressure through the bottom of the converter and the workmen were told to pour in the melted iron. Instantly came a dazzling shower of sparks and the dangling lid melted in the fierce heat. The air cock was beside the converter and no one dared to go near it. Finally the process of decarburization was completed and the new metal was tried, the problem was solved, and "Bessemer" steel had become a reality. In the next number of the SUPPLEMENT a full biography of Sir Henry Bessemer will be published.

SIR HENRY BESSEMER.

At the time the fiftieth anniversary number of the SCIENTIFIC AMERICAN was published, the readers of our journal wisely put themselves on record as considering that the Bessemer process was the greatest invention of the last fifty years. Sir Henry Bessemer made about $10,000,000 out of his discovery, and he was the recipient of scores of marks of distinction from the crowned heads of Europe and from the scientific and learned societies of the world. He received the honor of knighthood in 1879. He took out 120 patents, and the specifications fill two volumes and the drawings seven volumes. He is one of the greatest examples we have of an inventor whose labors were rewarded by every honor and whose material success was owing to the patent systems of all countries.

Cement for India Rubber on Metal or Wood.

The following is recommended by the Allgemeine Tischler Zeitung as a strong and lasting cement for rubber either on metal or wood, and hence will serve for cementing bicycle tires: Put 1 part of shellac, broken into small pieces, into 10 parts of ammonia water (strongest), and set aside for three or four weeks, or until the mass becomes entirely fluid. In use the liquid is applied to the India rubber surface, and the latter is applied to the metal or wood, and firmly wired or corded thereto. On the evaporation of the ammonia a most complete joint is formed between the two surfaces.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM BOILER.—Enos Hook, No. 106 East Fifty-fifth Street, New York City. This boiler has an outer and an inner shell, with water tubes depending from the crown sheet of the latter, and receiving heat from a fire chamber in the inner shell, there being also sets of longitudinal water tubes at opposite sides of the inner shell, between the depending water tubes and the inner shell. The longitudinal tubes end in header boxes in the inner shell and in open communication with the water space of the boiler. Covered hand holes opposite the longitudinal water tubes at each end enable them to be readily cleaned by a brush or scraper. The products of combustion return from the rear, through flues passing through the water space to the point of discharge, it being designed by this construction to afford greater heat-receiving area within the boiler than is usually attainable in boilers of this class.

Electrical.

AUTOMATIC CIRCUIT REGULATOR.—Joseph D. C. Chateau, Paris, France. This invention relates to a regulator for keeping the intensity of the current practically constant, and is particularly applicable to an apparatus for lighting and extinguishing gas burners at a distance. It comprises a magnet or coil, an armature, a resistance, two contact pieces between which the armature is arranged, and connections whereby the coil, the armature, the resistance and one of the contact pieces are in the main circuit, while the other contact piece is in a shunt circuit.

ELECTRIC RAILWAY.—Louise Scherpe, St. Louis, Mo., administratrix of John F. Scherpe, deceased. In underground trolley roads, where the main conductor is closed and protected against outside influences, to insure safe and constant transmission of the current to the car motors without charging the track and rails, this invention provides sealed switch boxes, at suitable distances apart, supporting the insulated main conductor, there being within each box a fixed contact on the conductor, while a plunger fitted to slide in the box is adapted to make contact with the fixed contact. Contact bars connect the plungers in pairs, and a current-conveying trolley is adapted to engage the bars to lift the plungers to make contact with the main conductor, which is thus connected with the car motor.

ELECTRICALLY OPERATED BRUSH.—Alfred Sherwood, Topeka, Kan. This invention provides an improvement in hollow cylindrical rotary brushes, inside of which is an electric motor, such brushes being more particularly adapted for barbers' use, to be connected with any convenient source of electrical power, the brush being of convenient form and readily managed. The invention covers a novel arrangement and combination of parts, including the brush and the motor and their bearings, and the yoke or bifurcated hanger by which the other parts are suspended.

Bicycles, Etc.

ELEVATED ROAD AND BICYCLE THEREFOR.—William J. May, Tillamook, Ore. A single rail is, according to this invention, carried by posts at a slight elevation from the ground, the posts also carrying on each side upper and lower guide rails. The wheels of the bicycle are designed to travel on the top of the rail, and on the front fork of the bicycle is firmly secured a frame from which depend rods carrying at each side a lower and two upper rollers or wheels adapted to bear against and travel along the upper and lower side rails, thus supporting the bicycle steadily in a vertical position, and enabling the most inexperienced rider to readily acquire facility in actuating the pedals and propelling the wheel.

Mechanical.

AUTOMATIC FRICTION GOVERNOR.—Cyrus Moore and Perry S. West, Perry, Mich. This is a governor designed for use on windmills, engines and other machines, being of simple construction and automatic in operation. It comprises a friction rim with the inside of which one or more brake blocks are adapted to move in engagement, in connection with levers fulcrumed on a wheel turning with the shaft or other movable part of the machine on which the device is used, there being a loose spring-pressed device connected with the levers to cause them to swing simultaneously inward or outward.

ADJUSTABLE STOP TEMPLET.—Jacob W. Tripp, New York City. This is a device used in cutting miters and fitting mitered joints in mouldings, and more particularly for fitting the joints in moulded bars when a portion of the bar is beaded, and this portion should be beveled in order to make a proper joint. The device may be advantageously used for mitering the ends of mouldings to form the corner joints of picture frames, the central bars of window sash, etc. The templet has flanges at right angles forming side and top bearing surfaces, and having beveled or miter gaging surfaces at each end, while an adjustable clamp jaw is supported from the top flange and adapted to engage the other side surface of the material.

SHAFT PROTECTOR.—Henry F. M. Podeyn, Brooklyn, N. Y. This is a device more especially designed for use on shafts at or near the floors or ground, and arranged to form a hood or cover over collars, flanges, couplings, set screws, or other parts projecting from the revolving shaft, to prevent the garments of workmen and others being caught thereon, and thus obviate danger of accident. The protector consists of a casing made in longitudinal sections adapted to be secured together, springs being arranged in pairs with their middle portions secured to the casing and their free ends resting on the shaft to support the casing from the shaft.

COTTON GIN.—Thomas B. Lee, Barnwell, S. C. This machine is of a class in which a series of toothed cylinders are arranged to coact in such a manner as to separate the fiber from the seed, boils and any foreign substances carried by the cotton, and comprises a main shaft provided with gear wheels while a series of vertical saw cylinders have their shafts provided with gear wheels and are mounted in adjustable bearings, gear wheels being interposed between those on the main shaft and those on the cylinder shaft, the interposed gear wheels being mounted in adjustable bearings. The same construction may be advantageously employed in machines for delinting cotton seed, barring wool, etc.

GATE VALVE.—Alfred N. Heine and William K. H. Woerner, Evansville, Ind. This is a valve for controlling the inlets and outlets of a valve having a plurality of ways, such as a four-way valve, the apparatus having one or more gates and means by which they may be adjusted about the several ways. Within the valve casing, which has four necks connected with a like number of conduits, is a threaded revoluble shaft on which a valve gate is mounted to move vertically by the revolution of the shaft, while gearing connected with the valve gate is capable of turning it around the shaft to adjust the gate, and also to hold it from turning during the action of the shaft.

BALING PRESS.—Skiles W. Bricker, Ore, Mo. This is a machine mounted on wheels, to be readily transported from place to place, and is especially adapted for quickly and smoothly baling hay, straw, etc., with comparatively little power. The invention comprises a pressing chamber communicating with a hopper and in which a plunger operates, while a feeding plunger is made in two sections, one section having a spring yielding connection with the other section, and there being connections whereby the feeding plunger is operated by the pressing plunger.

Miscellaneous.

CONVEYING APPARATUS.—George F. Newell, Richmond, Va. For use in handling material to be weighed at one point and packed at another, this inventor has devised an apparatus by which the weighed, proportioned, inspected, or other material may be conveyed to the packing point and the emptied vessels returned to the starting place, the apparatus being especially designed for handling manufactured tobacco, such as granulated tobacco, cut plug, etc. It comprises a main table having slots or openings in which operates a carrier belt having its upper run approximately in the plane of the table, a return carrier being located above the carrier belt and having its belt geared therewith, while switches are adjusted to discharge at either side of the carrier.

TREATMENT OF METALLIFEROUS ORES, ETC.—Edgar A. Ashcroft, Melbourne, Victoria. This is an improvement on a formerly patented invention of the same inventor for working, in conjunction with zinc-bearing ores and products, other ores and products, especially those containing copper and iron. The process consists in circulating a zinc-bearing solution first around the metallic cathodes of an electrolytic apparatus, then around the anodes of the electrolytic apparatus, the anodes consisting of the matte of the products resulting from the preliminary furnace treatment of products or ores containing copper and iron, whereby a solution containing copper and iron is obtained electrolytically, a part or the whole of the zinc being deposited as metallic zinc.

DUMPING WAGON.—Thomas Wright, Jersey City, N. J. In wagons such as are usually employed to haul and dump coal, gravel, etc., this inventor provides a novel means of supporting the body of the wagon on springs that are supported at their ends on the frame bars of the running gears, and also on the rear axle. The body of the vehicle is so connected with the supporting devices that the body will be adapted for easy reciprocation on the running gear frame to dump the load rearwardly and return the body to normal position with the exercise of but slight manual power.

FIREPROOF BUILDING.—John O. Whitenack, New York City. In a framing for holding fireproof blocks composing the walls or partitions of structures designed to be fireproof, this inventor provides some novel features. The wall is made of separable blocks, a facing plate extending along one edge, while a channel iron is secured to the facing plate, inclosing it and also inclosing the contiguous portion of the wall, I-beams, Z-beams and L-beams being employed.

FENCE POST.—Columbus C. Nearn, Fowlkes, Tenn. This post is made of glass, in the form of a tube closed at each end, to prevent the entry of water and other foreign matter, and on its outer surface is a series of pairs of annular ribs, each pair forming a groove in which the wire of the fencing may be turned around the post to fasten the wire thereto. The post cannot decay, and may have such ornamentation and modification of form as desired.

LIFE SAVING APPARATUS.—William G. Burton, Kingston, Jamaica. This is an apparatus more especially designed for saving the lives of sailors and others who may fall overboard from the decks of vessels, and consists of a transverse net supported at its upper end on the deck of the vessel, and arranged to be readily thrown over the stern of the vessel, when it will extend with its lower edge into the water below the keel and with its sides beyond the side of the vessel. The device is quickly lowered by a mechanism under the control of the officer in charge of the bridge, or the man having the wheel, and a rope ladder extends from the lower end of the net to the deck of the vessel, so that a person caught by the net may readily climb back to the deck.

KNOB ATTACHMENT.—Frederick Jones and James S. Brownson, Brooklyn, N. Y. This invention provides such construction of the spindle for a door lock and the sleeve of the removable knob that the two parts may be adjustably connected in a quick and convenient manner without using a screw in the sleeve of the knob or making holes in the knob spindle, the parts being also quickly separable if desired by the employment of a flat piece of metal or a screw driver. The construction is simple and inexpensive.

FOLDING STOOL.—Fred R. Upham, Leominster, Mass. A stool for use in stores behind the ordinary counters is provided by this invention, the stool being adapted to be compactly folded so as not to obstruct passageways, while it may be readily adjusted for counters of different heights and quickly folded and unfolded for use without stooping. It can be lightly and yet strongly constructed, and when in position of use affords a firm and steady seat for the user.

ASH RECEIVER.—Joseph Sedlmayer, Brooklyn, N. Y. This is an improvement for application to stoves and ranges, providing therefor devices for receiving and conveying the ashes to a suitable chute or receptacle. In the ash box is a chute connected by a discharge pipe with a flue connecting with the cellar, a discharge valve in the chute consisting of two hinged leaves and a sliding operating bolt, and there being at the top of the chute a sliding sifter. To discharge ashes from the stove or range it is only necessary to tip the sifter and open the valve.

CUSPIDOR.—John and Thomas Buckley, New York City. This is a device intended more particularly for use in hospitals and by invalids, and comprises an outer casing having a hinged top and bottom and provided with handles, while within is a cheap, destructible inner casing, preferably of paper or similar material, to be discharged and destroyed when the cuspidor is cleaned.

Designs.

TACK.—Henry F. Reuter, Nashville, Ill. In the double pointed tack provided by this design the inner opposite faces of the prongs are flat and parallel to each other, while the outer surface of the head is flat on top.

METAL WORKER'S STOCK.—Charles D. Graff, New York City. This design presents a waved border decorated with foliate scrolls, and a representation of a group of pine cones and pine foliage, the group following the curvature of the border.

MANDOLIN.—Eugene B. Baehr, New York City. The head of the neck of the mandolin, according to this design, is so arranged with respect to the neck itself that the opposite side edges are approximately parallel and at an angle trending laterally, all the keys being projected from one side of the head.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

PAPERS AND REPORTS RELATING TO MINERALS AND MINING. Comprising statement by the Minister of Mines, report on the gold fields, wardens' reports, report on coal mines, water conservation for mining and irrigation purposes, Otago and Westland districts, report on geology of Cape Colville Peninsula, chemistry of the cyanide process. Wellington, New Zealand. 1897.

THE LANGUAGE OF LIGHT; OR, THE MIRROR OF TRUTH. By Terence Duffy. Pp. 260. Price $2.

THE SALMON FISHERY OF THE PENOBSCOT BAY AND RIVER IN 1895 AND 1896. By Hugh M. Smith, Chief of Division of Scientific Inquiry, United States Fish Commission. Extracted from United States Fish Commission Bulletin for 1897. Article 4. Pp. 113 to 134. Plates 4 and 5. Washington. 1898.

NOTES ON THE HALIBUT FISHERY OF THE NORTHWEST COAST IN 1896. By A. B. Alexander. Extracted from United States Fish Commission Bulletin for 1897. Article 7. Pp. 141 to 144. Washington. 1898.

BIBLIOGRAPHY OF THE METALS OF THE PLATINUM GROUP. Platinum, palladium, iridium, rhodium, osmium, ruthenium, 1748–1896. By James Lewis Howe. Washington: Smithsonian Miscellaneous Collection 1084. 1897. Pp. 318.

The metals of the platinum group are interesting both from a chemical and an economical point of view, and the present bibliography will give a key to the literature upon the subject. This is another example of the splendid work which the Smithsonian Institution does for the "increase and diffusion of knowledge among men." No publisher could afford to print an exhaustive bibliography of this kind, as of course the sale would be very small; but the Smithsonian Institution generously undertakes to print books of this kind which could never be made to pay the ordinary publisher. It is little wonder that foreign scientific men hold the Smithsonian Institution in such high estimation as they do.

PLACER MINING. A handbook for Klondike and other miners and prospectors. With introductory chapters regarding the recent gold discoveries in the Yukon Valley, the routes to the gold fields, outfit required, and mining regulations of Alaska and the Canadian Yukon. Also a map of the Yukon Valley, embracing all the information obtainable from reliable sources up to December 1, 1897. Scranton, Pa: The Colliery Engineer Company. 1897. Pp. 146. Price $1.

This book is filled with practical information which miners are desirous of obtaining, especially those who are desirous of going to the modern El Dorado—the Klondike.

The Master Steam Fitter, of New York, has changed its name and now appears under the title of Engineering—Mechanical, Steam Heating, Electrical, Sanitary, Civil and Hydraulic. It is published monthly at 108 Fulton Street, New York. The subscription price is $2 per annum.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7382) W. H. G. asks: 1. Will you please tell me through your Notes and Queries in the SCIENTIFIC AMERICAN the proportions of sal ammoniac and water used in a Disque Leclanche battery? A. The solution of sal ammoniac in all Leclanche cells should be saturated. Dissolve about ¼ pound to the cell. 2. How many volts would one of these batteries give? A. These cells have about 1·4 volts when fresh. 3. How large a lamp would this battery run? A. They cannot be used for lighting lamps continuously. They run down in a short time on a continuous service. 4. Will you please give me an idea how to make a receiver and a transmitter for a small telephone? A. For a solid backed telephone and a Blake transmitter, see SCIENTIFIC AMERICAN, vol. 72, No. 7, price 10 cents. For a simpler telephone see SCIENTIFIC AMERICAN SUPPLEMENT, No. 966, price 10 cents.

(7383) C. W. R. writes: Will a bicycle having a 20 tooth sprocket on front and a 12 tooth sprocket on the rear run easier than one with a 17 tooth sprocket on front and a 7 tooth sprocket on the rear, both being a 68 gear, and the conditions in both cases being exactly the same, excepting the size of sprockets, and consequently, a little longer chain in the first case? If so, why so, and if not, why not? Which will have the most strain on the bearings, and how much more? A. The larger pair of sprocket wheels will run easier than the small pair. There is less strain on the axles and chain, and less friction on the bearing parts owing to the reduced strain on the larger sprockets. There is also less wear and liability to breakage, about in the ratio to the relative diameters of the two sizes of sprockets.

(7384) W. J. K. asks: 1. What is the voltage and amperes required in an electric furnace, the carbon points being ¼ inch apart? A. That depends on the work to be done. Anywhere to several thousand amperes at 5 to 10 volts. The electrical furnace has been very fully treated in the SCIENTIFIC AMERICAN SUPPLEMENT, ever since its invention. See Nos. 901, 904, 905, 976, 986, 1048, 1077, 1107, price 10 cents each. 2. What voltage and amperage is used in ordinary arc lamps? A. A 2,000 candle power lamp is one that consumes 450 watts or 10 amperes at 45 volts. 3. From what firm can I obtain soft iron wires? I have looked in quite a number of catalogues, but cannot find them listed. A. A good quality of iron wire heated red hot and cooled will be "soft." It will also be covered with a thin film of oxide of iron, which will improve it for use in magnet cores.

(7385) W. L. M. asks if the motor described in No. 759 could be run to any advantage by three bichromate potassium cells quart size. A. The motor requires the same number of cells to run it, no matter what their size may be. The larger cell will furnish a larger current. This may be controlled in the plunge battery, by immersing the plates to a less depth, but it makes no difference in the number of cells, whether they are of pint or quart size. The quart size will not need refilling so often.

(7386) V. M. asks how he can print the names of subjects on the sensitized paper of photographs. A. To print the name on the photograph several methods may be adopted. The simplest is to write the title of the subject on a slip of paper with aniline copying ink, or

with ordinary copying ink mixed with gamboge or vermilion. Then slightly dampen the surface of the negative near the bottom right or left hand corner in as unobtrusive and unimportant a portion of the picture as possible. Press down the paper with the writing upon it. Leave for a few minutes and then remove paper, when the writing will be found to have adhered to the negative. When printed, the name will print out white. Another way is to write backward on the negative, while another and better plan is to write the name in Indian ink on the surface of the paper before it is printed on. The ink will wash off in the after operations and leave the name in white where the surface of the paper has been protected by the ink. 2. Please give me some information of the billiard game known as the eighteen inch balkline game. A. We have no particulars regarding games of billiards.

(7387) M. T. says: Please refer me to SUPPLEMENT explaining how to construct a medical battery, or otherwise furnish as full instructions as convenient for coil and core of moderate strength. A. Complete directions for making a medical coil are given in SUPPLEMENT, No. 569, price 10 cents by mail.

(7388) C. H. R. says: Have you the formula for making a new method burnishing ink for boots and shoes? A. Four ounces shellac, 1 ounce borax, sufficient water. Boil to the consistence of sirup, and add a few drops of strong ammonia water A small amount of soap is sometimes also introduced. Add a sufficient quantity of this to the ink to obtain the desired result. Instead of the above, soap is often used alone, or with a trace of glycerine, ammonia or gum arabic.

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